Pope's Manual of Nursing Procedure

By AMY ELIZABETH POPE

ESSENTIALS OF DIETETICS

A QUIZ BOOK FOR NURSES

ANATOMY AND PHYSIOLOGY FOR NURSES

A MEDICAL DICTIONARY FOR NURSES

PHYSICS AND CHEMISTRY FOR NURSES
(WITH ANNA CAROLINE MAXWELL)

PRACTICAL NURSING

DIETARY COMPUTER

ASISTENCIA PRACTICA DE ENFERMOS
(Spanish Edition of Practical Nursing)
CON LA COOPERACION DE ANNA CAROLINE MAXWELL

Pope's Manual
of
Nursing Procedure

By

Amy E. Pope

Formerly Instructor in the School of Nursing, Presbyterian
Hospital, New York; Visiting Instructor, San Francisco,
Cal. Author of "A Medical Dictionary for Nurses,"
"A Quiz Book of Nursing," "Essentials of
Dietetics," "A Dietary Computer,"
and, with Anna Maxwell, of
"Practical Nursing"

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PREFACE

THIS book has been prepared more especially to facilitate teaching, by demonstration, as much of the practical work of nursing as is usually included in the junior year instruction. In addition, however, to the descriptions of demonstrations, directions are given for treatments which cannot generally be shown in class and precautions are mentioned which, though essential in the care of patients, cannot be carried out in class.

In compiling this work, the author has had in mind the method of teaching by demonstration that has seemed to her and others with whom she has conferred to give the best results; viz.: In preparation for class, the pupils are expected to read the sections devoted to description of the demonstration that is to be held and relative matter. During the class, which is a two-hour period, the instructor demonstrates and calls the pupils' attention to points of special importance; then some of the pupils, in turn, repeat the demonstration while the others watch and criticize. Some time after the class, the students are expected to practice what they have been taught and, at the beginning of the next class and subsequent periods, at least one of them repeats the procedure. During the final fifteen or twenty minutes of each period the instructor holds a quiz on the theoretical portion of the lesson.

Connecting the practical work of nursing with

correlated theory is, it is now very commonly considered, important; for the *raison d'être* and the methods of procedure of the majority of therapeutical treatments are based on physiologic and physical facts, and if the pupils study those connected with the procedure that is to be demonstrated, it will tend to heighten their interest in the demonstration and to make them realize the necessity for important detail. Also, such study affords a means of reviewing physiology, physics, etc., and of attaining mental associations with these subjects, that, for obvious reasons, will be more likely to promote frequent recall (providing the necessity for this is impressed upon the pupils) than do the reviews commonly held with materia medica and lectures on disease, and, as all instructors appreciate, recall is one of the most important factors in remembering.

For the above reasons, in compiling this book, the writer has endeavored to include the most important correlated physiologic and other data with each demonstration or else, when the students are likely to know the facts or can find them readily in their other textbooks, questions and references are inserted. This was done both to limit the size of the book and to endeavor to imbue the students with the ideas of recall and of questioning themselves regarding their understanding of what they are reading.

In deciding the order of the lessons, the author's aim was to place first those which demonstrate the work that probationers are usually required to do first on the wards and those which afford particularly good means for training the students to move, lift, and carry patients properly and to coöperate well

when working together. The order of the demonstrations of treatments was based on the similarity of either the procedure involved or the uses of the treatments.

The author has personally tested or seen performed all the demonstrations in this volume and the methods described are those which, after trials of various others equally good ones, seemed the easiest.

In enumerating the articles required for demonstrations, the ordinary furniture of the demonstration room, as bed and tables, and the bed linen and trays to hold the utensils, are not always mentioned because it was taken for granted that such things are always on hand.

Help with this book was sought and gained by consulting the recent issues of a number of medical magazines, especially *Progressive Medicine*, *The American Journal of the Medical Sciences*, and the *Journal of the American Medical Association*, and the following books: *Diagnostic and Therapeutic Technic*, Morrow; *Rational Hydrotherapy*, Kellog; *Diagnostic Methods*, Webster; *Principles of General Physiology*, Bayliss; *Principles of Hygiene*, Berger; *A Manual of the Practice of Medicine*, Stevens; and those books to which credit is given in the text.

The author takes this opportunity of thanking the many nurses who helped her in several ways, especially Miss Anna C. Jammé, Director of California Schools of Nursing; Miss Emmeline Mills, Instructor in the Peter Bent Brigham Hospital School of Nursing, Boston, Mass.; Miss Emily Bauer, Superintendent of Nurses of the Merritt Hospital, Oakland, California;

Miss L. M. Thom, Acting Superintendent of Nurses of St. Luke's Hospital, San Francisco, California, and her assistant, Miss Grace Kennedy. Also Meinecke Co. for the use of illustrations from their catalogues.

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A. E. P.

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CHAPTER I

Care of the Ward and its Furnishings

Ventilation. Dusting. The care and cleaning necessary for the proper condition and preservation of: sinks, toilets, and the like, ward utensils and linen, instruments and rubber appliances.

Essential conditions in a ward or sick-room and the environment are:

They must be: (1) Properly ventilated; (2) free from unpleasant odors; (3) kept at a uniform temperature (the degree required will, in some cases, depend upon the diseases from which the patients are suffering); (4) free from dust and dirt; (5) there must be a definite place for all furniture and utensils and everything must be kept in its place when not in use (this is especially important in the case of instruments and other articles that are likely to be needed in a hurry); (6) the furniture and furnishings are to be, as far as possible, free from stains and other defacement.

In order that such conditions may prevail it is necessary for nurses to understand something of the physical processes upon which ventilation depends and

of the chemical and physical processes involved in cleaning.

Demonstration 1

Methods of Ventilation

If the hospital is ventilated by mechanical means, the pupils will be shown as much of the system as possible and in preparation for the lesson they should read in their textbook of Physics[1] the sections devoted to the following subjects: The principles involved in artificial and natural ventilation[2]; the nature and causes of convection[3]; the meaning of relative and absolute humidity[4]; the nature and causes of evaporation[5] and the diffusion of gases[6]; the nature and results of photosynthesis and metastasis in plants.[7] Also they should read the sections on the composition of air and ventilation in their textbook of Hygiene.

As the result of their reading the pupils should be able to answer the following questions, to give the reasons for the procedures necessary for ventilation that are mentioned on pages 4 to 6, and to demonstrate methods of arranging the windows and ventilators.

State the chemical composition of pure air.

[1] The page references given here are for the revised edition of *Physics and Chemistry for Nurses*, Pope, G. P. Putnam's Sons, but the information required will be found in any textbook of Household Physics.

[2] Pages 8 to 12. [3] 79 to 81. [4] 60 to 62. [5] 55 to 57. [6] 61. [7] 301 and 302.

Nothing is said here regarding air space requirements and industrial impurities of the air, because the author has found that these subjects are better appreciated if studied later in connection with Institutional Management and Sanitation.

What is the average composition of air as it issues from the lungs?

What forces of nature are made use of in ventilation?

Why does heated air rise?

What is meant by convection?

Where will you provide an exit for air from a room that is ventilated by natural means?

Why is this not always necessary with mechanical ventilation?

Why will a fire in the grate assist in ventilation?

What causes a draft?

What is wind?

To what is wind due?

What is meant by humidity?

Why does humidity become excessive very quickly in a badly ventilated room in which there are a number of people?

What is the result of excessive humidity upon the body's heat-regulating capacities?

Why are the bad effects of humidity increased when the room temperature is high?

Why will the presence of growing plants in a room help to keep the air pure in the daytime but not at night?

Where does the world's supply of atmospheric oxygen come from?

Ventilation has been defined as "the continuous introduction of pure air into a room or building, thoroughly mixing it with the contained air, and the simultaneous extraction of a like quantity of impure air."[1]

[1] *Principles of Hygiene*, p. 66. Bergy. W. B. Saunders & Co.

In order to ventilate a room or building properly the following points must be observed:

The incoming air must be pure.

The air in the room must be kept in as active movement as possible without the motion becoming perceptible to the inmates, *i. e.*, without causing a draft. The more important factors determining the amount of air movement in a room are: (a) difference in the temperature of the incoming air and that in the room, the greater the difference the more intense the movement; (b) the volume of incoming air; (c) the relative position of the openings for the entrance and exit of the air. If the openings are directly opposite each other a draft can be created through that part of the room without inducing enough air movement in the rest of the place to keep the air pure.

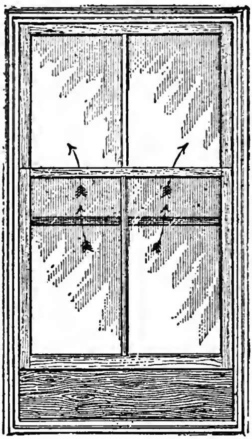

Fig. 1. The arrows indicate the direction taken by the incoming air

The space for the entrance of air should be larger than that for the exit.

If there are two windows in a room one should be opened at the top and the other at the bottom. If there is only one window, unless it can be opened widely, better ventilation will be secured by opening it at the top and bottom than by the same space of opening in one place only. In very cold weather there may be so much difference between the temperature of the incoming air and that in the room that

an arrangement such as shown in Fig. 1 may induce enough movement in the air to secure good ventilation. As shown in Fig. 1 a narrow board is placed beneath the lower sash so as to raise the upper edge of the latter above the level of the bottom of the upper sash and the cold air entering between the two sashes is deflected upward, and thus it will not impinge upon the people in the room.

Cause of odor, etc.: It is very commonly thought that the odor in a badly ventilated room and the inertia and drowsiness that the inmates often experience are due to the excessive amounts of carbon dioxid that collect, but CO_2 is an odorless gas and it has no actual injurious effects on the system in the amounts in which it ordinarily accumulates in houses and hospitals. In reality, the odor is commonly due to decomposed skin excretions and to exhalations other than CO_2 given off in the breath from, chiefly, the stomach and mouth; and the lassitude, etc., result from interference with heat elimination due to deficient air movement, excessive humidity, high room temperature, and consequent vasomotor changes which increase the amount of blood in the skin and lessen the brain supply.

Though the emanations mentioned in the preceding paragraph are not injurious to health, they are not to be tolerated in house or institution because they are signs of poor ventilation, and consequently of the presence of the harmful, though less easily appreciated, conditions. Unfortunately, the olfactory nerve endings become accustomed to such stimuli very quickly, and thus after a person is in a badly ventilated room for a short time consciousness of the odor diminishes. Therefore, nurses should accustom

themselves to being on the alert when they enter rooms to detect odors and to at once remedying matters.

Precautions necessary to prevent odors in hospitals, in addition to adequate ventilation, are:

1. Cover bedpans as soon as you take them from a patient. Keep them clean—free from the smallest speck of soil—and deodorize them when necessary. Formaldehyde is a good deodorizer to use for this purpose.

2. Prevent the bed covers from becoming permeated with fecal odor by replacing them with a bath blanket (which can be aired) when you give the patient an enema.

3. Keep the patients and their bedding clean.

4. See that dressing and garbage pails are emptied on time and that they are kept clean, that hoppers and toilets are properly flushed (*i. e.*, until every particle of waste is washed off) and a deodorant used when necessary, as, for example, after emptying a particularly offensive stool.

5. Keep waste pipes of sinks and hoppers free from obstruction. Fat is a common cause of obstruction in kitchen sinks, and to prevent this pour a hot, saturated solution of sodium carbonate into the pipe once or twice a week. Do not allow the solution to come in contact with the enamel of the sink, for it will soon roughen it. The causes of obstruction in toilets are many, for, unfortunately, there are more than a few people who are selfish enough to risk entailing expensive plumbing repairs in order to save themselves the trouble of walking to a garbage can or wastebasket.

The temperature of the ward and sick-room is a most important consideration. A low temperature,

providing the patient's body is kept warm, will often act as a respiratory and circulatory stimulant, and patients who are restless and excited will frequently become quieted and go to sleep when they are put out of doors, even in winter. On the contrary, a hot ward at night will invariably mean restless, if not sleepless, patients. Patients with chronic diseases associated with poor circulation and anemia usually require warmer surroundings than fever patients and those in shock or under the influence of an anesthetic need, temporarily, a still warmer environment.

Room temperatures commonly advised are: For pneumonia patients and many febrile conditions, as low a temperature as can be ordinarily obtained without having the patient in a draft; for the general ward, 68° F., during the daytime and 65° F. at night; for bathrooms, 70° F.; for treatment and recovery rooms,[1] 72° F.; for the operating room, during operations, about 78° F.

Demonstration 2

Dusting and Cleaning

Requisites for demonstration: (1) A dusting basin containing warm water, two dusters, a cake of soap or of bon ami on a dish, or a can of bon ami powder, a wooden toothpick. (2) Floor mops and brushes and brush covers, and a vacuum cleaner, if this is used in the hospital, and any other cleaning appli-

[1] Rooms in which patients are kept after operation until they regain consciousness.

ance the use or care of which should be demonstrated.[1]

Points to remember: It is most important to keep places where the sick are cared for free from dirt and dust, for this may contain material that will afford food for germs, and thus aid in the spread of infection.

Use a damp, not wet, duster when cleaning articles that will not be injured by moisture. Things that will be are: electric light fixtures, lacquered metals, surfaces colored with water paints, kalsomine, shellac varnishes, or wax.

Wash your duster whenever it is soiled and change the water in the basin as often as necessary; it is impossible to make things clean with dirty dusters or water.

Dust the higher shelves, etc., before the lower ones.

Form the habit of removing dust with one firm stroke, it is waste of time and energy to move the duster back and forth over a surface. When dusting a bar put your hand, enclosing the duster, around it.

Remove dust from cracks and crevices, that are too small to put the duster in, with the point of a wooden toothpick.

When dusting a bed, do not forget the bars that are out of sight.

[1] It should hardly be necessary to teach women how to dust, but experience shows that it is, and the rapidity with which new sinks, bath tubs, and the like are ruined in hospitals makes it evident that the majority of people know very little about the action of detergents on enamel, glass, etc. Space here will not permit of going into details further than the most essential points, but the information needed will be found in chapters xvi. and xvii. of *Physics and Chemistry for Nurses*, Pope, G. P. Putnam's Sons, and in any book of Household Chemistry.

When dusting a room after a patient has left it, do not forget the cupboard shelves, hooks and hook supports, cornices and baseboard; the bureau drawers and their supports; the roller of the window shade; the toilet utensils, the bars of the chairs and tables. Even if a maid or orderly does this work, the nurse in charge of the room is responsible for it. Form the habit of, when finishing work of this kind, looking around and assuring yourself that nothing has been forgotten.

When adjusting the surgical dressing carriage, be careful not to move the covers of jars containing sterile material, and *put everything back in its place.*

When cleaning the medicine case, only remove a few bottles at a time, so that if you are called away you will not have to leave them out of place; *never leave medicines out of the case and always lock the latter when you leave it.*[1] Put the bottles back in their place and see that those marked "Poison" or "For External Use" are separate from others.

Do not use strong alkaline or granular detergents for cleaning enamel or glass. Hospital sinks, bath tubs, medicine cases, and enamel utensils are frequently ruined in this way.

Use soap or bon ami for bath tubs, etc., and, if very dirty, kerosene.

A good method of cleaning the glass of dressing carriages, medicine cases, and the like, is to wipe them with a clean, damp duster; make a paste, the consistency of a thick cream, of hot water and powdered bon ami and rub this sparingly over the entire surface,

[1] This rule has been made in hospitals because despondent patients have secured poisons from unlocked cases and committed suicide.

let it dry, and then remove it, and polish the glass by rubbing with a clean, lintless, dry duster. This, plus a little ammonia water, is also good for cleaning nickel and aluminium. There must, however, be very little ammonia in the paste used for the latter metal, because it is ruined by alkaline and acid detergents.

Bon ami is one of the best detergents to use for surfaces that are painted white, but not for colored paints; for the latter dilute soapsuds made of warm water and neutral soaps, as ivory or white castile, are best.

Dust is never to be blown around and scattered in hospital wards or sick-rooms, and for this reason the floors are not swept, but either cleaned with a vacuum cleaner or dusted with an o'cedar or other mop that will hold the dust, or, especially for a large ward, a damp, not wet, duster is pinned around a long brush and used in the same way as a mop, and the duster is changed as soon as it is soiled.

After use all dusters must be washed with soap and hot water and hung in the places provided for them. Mops and brooms should be hung up and not allowed to stand on the floor. O'cedar mops can be easily cleaned when necessary by soaking them in kerosene and then washing them with hot soda water. When they are dry, they will need an application of polishing oil; only a small amount of this should be put on at a time.

Methods of Removing Stains from Linen, etc.

To maintain a neat appearance in hospital wards and rooms without undue expense it is most important

that the bed and toilet linen be kept free from stains, and, if this is to be done, anything that becomes stained must at once be put into warm (not hot) water, and left in it until there is time to eradicate the stain. The stains most frequently made on hospital linen are with ink, iodine, permanganate of potash, silver nitrate, and vaseline.

Easy methods of removing these are as follows[1]:

Ink: Cover the spot with lemon juice and add salt; put the material in the sunlight. When the lemon juice dries wash the stained part with warm water and soap, if the stain has not disappeared, make another application of lemon juice, etc., and repeat the process.

Iodine: Wash the spot with ammonia and hot water.

Permanganate of potash: Wash the stained part with (a) a solution of oxalic acid, (b) ammonia water, (c) clear water.

Silver nitrate: Cover the spot with tincture of iodine, let this stand for a few minutes, and then wash the part with (a) ammonia water, (b) clear hot water.

Vasoline: Wash the spot with (a) kerosene, (b) soap and hot water.

Stains made with **bichlorid and iodine on metal** can be removed with Universal Metal Polish (made by Borsum Bros., N. Y.), and U. S. Infallible Metal Polish (made by Hoffman, Indianapolis, Ind.).

Rust stains on iron and steel can be removed with kerosene. Be careful not to use this on a stove near a time that fire will be needed, for it is inflammable.

If alcohol is spilled on a surface painted with white enamel, pour oil over the spot at once, before attempt-

[1] In all instances the material is to be wet with warm water when the eradicating agent is applied.

ing to wipe up the alcohol, as, otherwise, the enamel, being soluble in alcohol, will be removed.

White stains on colored wood, such as are made by putting hot articles on them, can often be removed by rubbing with a mixture of equal parts oil and alcohol, or of oil and turpentine.

Rust and many stains can be removed from **enamel and granite utensils** by washing them with (a) kerosene, (b) hot water and soap. The enamel of such utensils is easily cracked by knocks, by allowing the utensils to remain over a flame when they are empty or approximately so, by the use of strong alkaline detergents. When the enamel is cracked, the utensils rust very readily. To prevent rusting the utensils should be dried before being put away.

Demonstration 3

Care, Cleaning, and Disinfection of Instruments and Rubber Utensils after Use

Requisites for demonstration: Samples of the instruments, syringes, and the like that junior nurses will be called upon to clean.[1]

Procedure in cleaning and sterilizing instruments: Separate the sharp and blunt instruments if they are together.

Count them.[2]

Open or unclasp jointed instruments, remove wires

[1] It is the disinfection of instruments, etc., after use that is considered here; the preparation of these things for dressings and treatments is described in Chapter VII.

[2] Instruments are frequently lost or ruined by being thrown into the bag with soiled dressings or by being gathered up with dressing towels and sent to the laundry.

from hollow needles, and pull out the pistons of syringes.

Rinse them in cold water until all blood and discharge is removed.[1]

Sterilize them as described below, taking all the precautions mentioned.

Scrub them as described, page 15.

Rinse them in clear hot water and then *dry them thoroughly.*

Put those that have been unclasped together.

If there are any that are only infrequently used rub them with oil; this will keep them from rusting.

Unless a rack that will keep them from coming in contact with anything is provided for sharp instruments, protect their points with a cot of non-absorbent cotton.

Put them away, and count them to see that the supply is intact.

Details of Procedure

To sterilize instruments: Blunt ones are boiled in a 1 %[2] sodium carbonate solution for, in some hospitals, five and, in others, ten minutes; scissors and needles and, sometimes, knives are boiled for three minutes, but as boiling, even with care, blunts the cutting edge of instruments, knives, which are easily rendered sterile if they are very well scrubbed, are sometimes disinfected by letting them stand in

[1] Blood, pus, and other body discharges contain albumin which is hardened by heat, and thus, unless removed before the instruments are sterilized, it will become so adherent that it will be difficult to remove.

[2] Sodium carbonate inhibits the blunting and rusting of instruments by sterilization and assists in their disinfection.

alcohol 75 % for thirty minutes; there are also certain articles, such as cystoscopes, thermometers, and some suction pumps and syringes that are ruined by boiling, and these must be sterilized in this way,[1] or, in the case of suction pumps that are ruined if alcohol or water gets into their valves, by wrapping them in gauze wet with lysol or other disinfectant[2] and keeping this wet for at least thirty minutes. When syringes are disinfected as described above the barrel must be filled with the disinfectant.

Points of special importance to remember when sterilizing instruments are:

Sharp instruments are not to be sterilized with others.

Unless the sterilizer tray is provided with a support for scalpels, bistouries, and needles, protect the points of the instruments with absorbent cotton and of the hollow needles by laying the needles on a gauze compress, and to hold them in place, run wires through the gauze and over the needles; suture needles can be run through the gauze, but doing this often dulls the fine points of the hollow ones.

Lay all instruments on the tray with their blunter ends in the same direction and, when lowering the tray into the sterilizer, hold it either absolutely flat or with the blunt ends of the instruments downward.

Do not put the instruments into the sterilizer until the water is boiling and the soda has been added.

Never allow sharp instruments to remain in the water one second longer than the stated time.

Put glass articles, as catheters, syringes, and nozzles

[1] Lysol 1:200 or formaldehyde 4 % is often substituted for alcohol for these articles, especially the glass ones.

[2] Bichlorid of mercury must never be used, for it discolors metal.

into the sterilizer while the water is cold. Boil them for five minutes.

For methods of sterilizing rubber articles see page 17.

Wash glass utensils with (a) warm water and soap, (b) hot water.

Scrub metal instruments on the board kept for the purpose with a cork or, except the cutting points of knives and scissors, a soft brush. Either bon ami, sapolio, or emery can be used as a detergent. If any of the instruments are rusty, soaking them in kerosene before scrubbing them will facilitate the removal of the rust. Be sure and remove all trace of the detergents in the subsequent rinsing.

Dry the instruments most carefully; this, except the interior of the needles and canulas, is generally done with gauze or soft muslin.[1] It is well before starting to dry the interior of hollow needles to attach them to a syringe and alternately draw and expel alcohol or ether[2] into and from them three or four times. Dry them by alternately inserting and removing their wires until the latter are perfectly dry when removed; dry the wire each time it is removed. When a needle is thoroughly dry insert the wire and see that it extends as far as possible beyond the point of the needle, as this will help to protect the latter. Treat canulas in the same way as needles, using the trocars instead of wires.

To clean and disinfect rubber gloves, wash them in cold water. Boil them for two minutes.

[1] The gauze or muslin used for this purpose is not to be thrown away.

[2] The alcohol or ether can be kept in a small covered jar or wide-mouthed bottle and drawn from this and returned to it from the syringe.

Wash them on both sides with warm water and soap.

Fill each one in turn with water, or else inflate it with air, to see if there are any holes; put aside those which have holes.

Dry all the gloves thoroughly, but keep those with holes separate; dry each one first on the outside, and then, after turning it, the inside.

It is a common custom in hospitals to have the gloves sterilized after they have been cleaned, so that they will be ready for use when needed, and the following method of doing this is one very commonly used:

Powder them inside and out with sterile talcum powder.

Fold the wrist of each glove outward so as to form a cuff.[1]

Encase each pair with a little package of talcum powder[2] in a muslin folder.

These packages are sterilized in the autoclave for ten minutes at fifteen pounds pressure.

To repair gloves with holes: Put each glove in turn on the form provided for the purpose and paste a small piece cut from a discarded[3] glove over the holes. After the cement is dry, balloon[4] the gloves with air to ascertain if the patches are firm.

Proper care of rubber appliances is very essential, for they are expensive and easily ruined, especially

[1] Folding the wrist of the glove in this way makes it possible to put on the glove without touching the outside.

[2] The powder used for this purpose is rolled in paper and sterilized in the autoclave for thirty minutes. The packages are kept in sterilized containers until needed.

[3] All gloves that are too torn to be mended are kept for this purpose.

[4] Shake the glove until its sides are separated and the glove filled with air, and then hold the wrist with the opening closed.

by heat, moisture, oil, acid, and alkalies; also they are easily scratched by granular or rough substances, and readily cracked, torn, and punctured.

Therefore, soiled rubber appliances must be always well and carefully cleaned after use; if they are sterilized, they must not be left in the boiling water longer than necessary (this is usually five minutes), they must not be sterilized with instruments, both because these may puncture the rubber and because the sodium carbonate injures it; and they must be very carefully dried before they are put away. Stomach tubes, rectal tubes, and catheters are always sterilized after use. Rubber dressing sheets as a rule are only sterilized after use for a patient with a septic wound or an infectious disease, and in such case, except when there is a virulent infection, they are often disinfected (instead of being sterilized) by soaking them in formaldehyde 2 %,[1] or carbolic 1:40, or some equally efficient disinfectant,[2] for from two to six hours according to the nature of the infection. Hot-water bags and ice-caps are treated in the same way as rubber sheets.

Some important points to observe in the cleaning and care of rubber articles are as follows: If the soiling matter consists of any substance that contains protein, as blood, pus, serous fluid aspirated from cavities, fecal matter, urine, the appliance must be rinsed with cold water as soon as possible, for if such soil is allowed to dry upon the rubber or if the article is put into hot water the soil may become

[1] When formaldehyde is used the container must be kept covered.

[2] Bichlorid of mercury should not be used if there is any metal on the article nor for white rubber. For reasons, see Bacteriology.

so hardened that its removal will cause a break in the rubber.

Most rubber appliances are best cleaned by scrubbing them with a soft brush and soap or lysol solution and warm water and then rinsing them in clear warm water. They should be wiped as dry as possible with a towel, and then, if possible, hung up until they are perfectly dry.

Rubber sheets will wear better if they are kept hanging over a bar, instead of being folded; if, however, they must be folded, the folds should be as large as the space in which the sheets are kept will permit, and nothing heavy is to be put on top of them.

Rubber tubes, such as lavage and rectal tubes and catheters, should be, after use, held under the cold water faucet of the hopper and the water allowed to run through and over them until all soil is removed. They are then rolled in gauze and sterilized for five minutes; the water should be boiling when they are put in, and they should be removed as soon as the time has expired.

Wash them as described on page 17; dry their exteriors with a towel and their interiors by stretching and squeezing the tubes and wiping off the drops of water that appear at the open ends; continue the process until there is no more moisture visible. This is most important, for if water remains in a tube it will soon be rotted. Such tubes will last longer if they are kept where they can lie perfectly flat than if they are coiled. If they are coiled, however, the coil must be very loose, as any compression tends to crack the rubber. Gastric lavage tubes are to be kept separate from any other tubes and also rubber catheters that are used for catheterizing. There

should be some mark to distinguish catheters used for this purpose from those used for rectal treatments.

The tubing of irrigators, douche cans, and the like should hang with the stop-cock open, so that it can drain, and not be coiled (as is very commonly done) within the utensil, for if such tubing is coiled its interior remains moist, and this will cause it to rot and small particles of rubber may then be washed into wounds.

To dry the interior of an ice-cap, after draining out all the water, put a dressing towel into the cap and let it remain for a short time to absorb the moisture; then let the cap stand for a while with the cover off and its walls pulled up so that they well be held apart with air. Dry and put away the cover as soon as the use of a cap is discontinued, otherwise it or its washer is likely to be lost. When the cap is dry put on the cover, keeping enough air in the cap to prevent its sides coming in contact. This must always be prevented with caps and similar appliances, for otherwise, if the rubber is at all moist, the sides may adhere. When inflated with air in this way caps can be very easily punctured and therefore they must be kept in a drawer or box by themselves.

To dry the interior of hot-water bottles hang them open end downward with their stoppers out, but attached to the handles with a chain or string. Hot-water bags that are in frequent use are generally kept hanging in this way when not required, but, should they be put away, they must be inflated with air in the same manner as ice-caps.

Rubber articles that are not used frequently will last longer if they are covered with talcum powder.

Hard rubber articles are cleaned in the same way

as those of soft rubber, but, as they are softened more or less by boiling, they are usually disinfected in the manner described on page 17.

Silk catheters are cleaned in the same way as rubber ones, but they need special care in their sterilization. They must be boiled in just enough water to cover them so that they will not float and come in contact with each other (nothing else should be in the sterilizer at the time), but they must be kept covered with boiling water during the process. They must on no account be put into the sterilizer until the water is boiling and must be removed the minute the required time—five minutes—is up. Special corrugated trays are to be had which facilitate sterilizing these catheters without injury.

CHAPTER II

Bed-Making

How to strip, air, and clean a bed. Principles of bed-making. Methods of making: a closed bed, an anesthetic bed, a fracture bed, a bed with a patient in it. Methods of moving a patient when: making bed, turning pillows, changing nightgown, changing and turning mattress.

Demonstration 4

How to Strip and Air a Bed

The important points to be considered are:

To save time and energy by doing the work in an order that will entail going around the bed as seldom as possible.

To so arrange the clothes after they have been removed from the bed that they will be all exposed to the air.

Not to soil the clothes by dragging them on the floor.

Procedure: Remove everything from the bedside table and place two chairs back to back two feet apart.

Place the pillows upon the table or the seats of the chairs.

Fold the spread in its creases and hang it where it will not get crushed.

Loosen the clothes all around the bed. To do this raise the edges of the mattress by passing one hand

along under it, and draw out the clothes with the other hand.

Remove the clothes, one at a time, taking hold of each article in the center (this will prevent their ends dragging on the floor), and place them over the back of the chairs. Hang the rubber sheet over a bar of the bed.

Turn the mattress over from top to bottom[1] and stand it, arched, on its upper and lower ends. The bed should air for at least twenty minutes.

Demonstration 5

To Air and Clean a Bed after the Discharge of a Patient

Requisites: Whisk, skewer or thin strip of wood with a small piece of absorbent cotton wound around one end, newspapers or an old rubber to protect the floor, bon ami, a pail or basin of warm water, and, sometimes, a basin containing a disinfectant.

Procedures: If the patient has had an infectious disease the bedding is usually fumigated or disinfected or, especially in the home after non-virulent infections, exposed to the air and sunlight for several hours. Otherwise proceed as follows:

Loosen the clothes as described in the preceding demonstration.

Fold the linen and pile it together or else put it directly into the clothes hamper.

Hang the blankets over the backs of chairs (it is

[1] The mattress should not be turned from side to side, for, if it is, the same part will again bear the heaviest weight of the patient and the mattress will become dented sooner than it will if properly cared for.

better, when possible, to use other blankets when making the bed so that those which have been in use may have a longer time to air).

If possible, a fresh rubber sheet should be used and the one on the bed removed and later thoroughly scrubbed and disinfected, but if it has to be used before it can be so treated, spread it on top of the mattress and wash it with a duster moistened with a disinfectant, lysol, about 3 %, being a good one to use, as it is a detergent, and then hang the rubber over a bar of the bed to dry. Whisk the mattress thoroughly, paying special attention to tufts and seams, and do not forget the sides, top, or bottom; stand it, arched, on its ends to air.

Whisk the pillows and springs of the bed.

Wash the bed with warm water and bon ami, using the covered skewer to clean crevices and, if there are any, the spirals at the top and foot of the bed. Do not forget the bars and the under surfaces of the springs.

In some hospitals, the mattress and pillows are whisked and the bed, following the use of bon ami and water, washed with a disinfectant, usually formaldehyde, but it must be appreciated that such treatment cannot be relied upon to kill either germs or vermin, since the bedding is not sufficiently saturated with, nor exposed long enough to the influence of, the disinfectant.

Leave the bed, etc., to air and dry. If they are in a room, open the windows; if in a ward, put the pillows on the springs and the blankets over the head of the bed, and, if the bed cannot be put out of doors, place a screen around it; if it can be put outside pin the blankets to keep them from being blown down.

Principles of Bed-Making

The exact methods of making beds differ somewhat in different hospitals, but **the fundamental principles** are the same in all institutions and are always to be considered when making beds for the occupancy of a sick person. They are:

1. The mattress must be protected.
2. The sheets under the patient are to be so fixed that they will remain without wrinkles.
3. The upper clothes on a "closed bed" should be so arranged that they can be turned down when the bed is opened without disturbing the under sheets.
4. The upper clothes must not be too tight over the patient's feet.
5. Loss of time and energy are to be avoided.
6. The bed must look neat and, in a ward, all the beds should look uniform, because uniformity is necessary for a neat appearance, and the maintaining of a neat appearance is an essential element in promoting cleanliness.
7. Keep the surroundings neat while you work, and do not consider your work with the bed finished until you have put the chairs and table in place, removed everything that should not be left on the table, and, in the ward, if there is a window near the bed, seen that its blind is straight.

The ways of complying with these principles are as follows:

1. The mattress is covered with either (a) a snugly fitting, washable cover, which is usually made of plain ticking or heavy unbleached muslin, (b) a cotton pad, or (c) a rubber sheet. When either b or c are used, it is well to have a buttonhole in each corner

and buttons on the corners of the mattress. In addition, for the better protection of the mattress, while it is necessary for the patient to use the bedpan, a rubber sheet or a quilted pad three to four inches narrower than the draw sheet, but long enough to tuck under the mattress at the sides, is put under the draw sheet.

N. B. *Rubber sheets with holes in them, even very small holes, are about useless.*

2. To keep the under sheets free from wrinkles, they must be (a) put on perfectly straight, otherwise the material is, as it were, on the bias, and if the sheet becomes at all loosened it will wrinkle; also, when making the bed with a patient in it, unless the sheet is perfectly straight when it is passed under her, it will be impossible to free it from wrinkles, for pulling the biased material will cause wrinkles. (b) The sheets must be stretched tightly and (c) the ends tucked under the mattress to the center line so that the patient's weight will be over them and help to keep them in place.

3. The ends of the upper clothes should not be tucked as far under the mattress as the lower ones or the latter will be pulled out when the bed is opened.

4. It is the top sheet more than the spread of blankets that is likely to be drawn tightly over the feet; to avoid this, a small pleat can be made in the sheet at the bottom corners of the bed after the sheet has been tucked in at the foot.

5. Have everything needed for the work at hand before beginning and do the work in the order that will necessitate going around the bed as seldom as possible.

Demonstration 6

To Make a Closed Bed

Adjust the protector.

Cover this with a sheet. Let the sheet extend about eighteen inches beyond the mattress at the top to allow for tucking in, be sure that the sheet is straight, and leave exactly the same length on either side. Tuck it under the mattress along the side at which you are standing.

Put on the rubber sheet,[1] placing it where the patient's buttocks and thighs will rest. Tuck it in on the one side.

Cover this with the draw sheet.[2] Leave the latter a little bit longer on the side at which you are standing than the other. Tuck it in on this side. It should extend from slightly under the pillow to about the same level of the patient's knees and at least two inches beyond the top and bottom of the rubber sheet.

Go to the opposite side of the bed. Turn back the draw and rubber sheets, so that they will be out of your way while you first stretch, and then tuck the under sheet beneath the mattress. To do this begin

[1] The necessary width of the rubber sheet depends upon the nature of the mattress protector. If this is of rubber or heavy quilting a sheet between two and three feet wide is generally all that is required.

[2] The draw sheet is so called because a part is supposed to be drawn from one side to the other when the sheet under the patient gets warm, so that a cool place can be provided for her to lie on. In some hospitals special sheets are provided for the purpose; when this is not the case, it is generally necessary to put the sheet with the length across the bed, for the width of the ordinary sheet is never sufficient to allow of it being drawn back and forth as required.

in the center and work first toward the foot and then toward the head of the bed.

Fold first the top and then the bottom of the sheet like an envelope and tuck them under the mattress. (Having the mitered corners at the top and bottom, instead of at the sides, as is a common custom, makes it easier to tighten the sheets and, when necessary, to push the ends of the mattress up in order to have them straight, and not curved or sagging as often happens with old mattress.[1])

Put on the top sheet with the hem wrong side up, so that the right side may be uppermost when the sheet is turned down over the blanket, turn the width of the hem under the sheet and have the upper edge of the fold on a line with the rim of the mattress. Tuck the sheet under the mattress at the bottom; miter the lower corner of the sheet at the sides and tuck these under the mattress. Stretch the sheet before tucking it under on the second side.

Put on one blanket with its upper edge within six inches of the top of the mattress, fold it back under itself at the bottom, tuck it in on the sides, but before tucking in the second side, stretch the blanket tightly, for it is largely upon the tautness of this blanket that the good appearance of the bed depends.

Put on the second blanket, fold the sides under

[1] When the corners are wanted at the sides instead of at the top and bottom of the bed, proceed as follows: Tuck the sheet under the mattress at the top, go to the foot of the bed, pull the sheet firmly, and tuck it in there. Miter (*i. e.*, fold like an envelope) the upper and lower corners and then tuck in the sheet along the side on which you are standing. Arrange the other side in like manner, but pull it tightly before you tuck it in. Before going to the other side of the bed to do this, adjust the rubber and draw sheet in the same way as for the other method.

the body of the blanket[1] along the sides; tuck it under the mattress at the bottom.

Put on the spread evenly, with its upper edge on a line with the top of the mattress; tuck it in at the bottom; miter the corners at the side, and tuck in the lower part of the miter folds, but allow the sides to hang as in Fig. 2 or else perfectly straight.

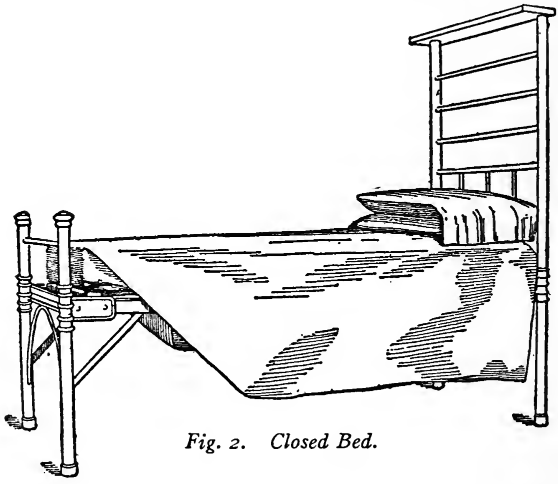

Fig. 2. Closed Bed.

If necessary, put clean cases on the pillows; shake them; get their corners into those of the cases; press them on a table until they are perfectly flat. Place them on the bed. Their arrangement on the bed differs in different hospitals; the main point is that in a ward it should be the same on all the beds.

When the bed is to be occupied at once, the following differences are made in the arrangement of the upper clothes:

[1] Folding the blankets in this way makes a sharp edge around the bed and helps to give it a neat and finished appearance.

Make a small tuck in the sheet at the lower corners; do not fold the blankets along their edges, but tuck them like the sheet and spread under the mattress at the bottom, and fold their corners at the sides so that they make a sharp edge at the junction of the sides and foot of the mattress; tuck the blankets and sheet under the mattress at the sides for only about twelve or fourteen inches. Make no change in the arrangement of the spread at the foot, but at the head turn it back over the blanket and fold the upper edge of the sheet over this.

Then **turn down the covers.** There are two common methods of doing this: (1) Grasp the upper edge of the clothes on either side the bed between your thumbs and fingers and fold them down to the center of the bed, draw the upper half of this fold upward, making a double fold with the upper edge of the clothes facing the head of the bed. (2) At one side turn back the upper half of the clothes in a triangular fold. This will mean that the upper edge of the clothes will lie along the edge of the mattress at the side farthest from you.

Demonstration 7

An Anesthetic Bed

The principal points to be considered in making an anesthetic bed are:

1. The mattress is to be particularly well protected (the rubber sheets must be examined to see that they are without the slightest suspicion of holes) and pillows are to be covered with rubber cases put on under the white ones.

2. The bed is to be thoroughly warmed and extra blankets provided.

3. The bed and its covers are to be so arranged that there need be no delay in putting the patient into it when she is brought from the operating room.

4. Nothing (*e. g.*, table or chair) is to be left where it will be in the way of the stretcher or of those lifting the patient from it.

5. All the articles required if the patient vomits or is in poor condition are to be placed where they can be reached instantly.

6. **Care necessary in filling hot-water bags:** Remove the stopper and roll the bag from the bottom upward so as to expel the air; otherwise the hot water is likely to spurt over your hands while you are filling the bag, being forced out by the expanding air.[1]

Do not use water hotter than 170° F.

Do not fill a bag to its full capacity.

After inserting the stopper, hold the bag upside down for a few seconds to ascertain if there is leaking; this most frequently occurs around the stopper as the result of absent or defective washers.

Put the hot-water bag in a flannel bag, stopper first, so that if the protector becomes loosened the metal stopper will not come near the patient, for, as metal absorbs and parts with heat more readily than rubber, it is more likely to cause a burn.

The reason for these precautions will be seen in Demonstration 13.

Requisites: three sheets; two woolen blankets; two

[1] Why will the air in the bag expand when hot water is put into the latter?

bath blankets; ether rubber[1]; an ether slip[2] or an extra sheet; a pillow or pillows (the number needed will depend upon the position in which the patient is to be placed); a rubber and a linen case for each pillow; a nightgown; a dressing towel; hot-water bags; the articles needed if the patient vomits or clenches her teeth, viz., kidney-basin, mouth-wipes,[3] wooden tongue depressor or mouth gag; a small paper bag for the reception of soiled mouth-wipes; *shock-blocks* or whatever the institution provides to raise the foot of the bed when the patient is in bad condition and the head of the bed for Fowler's position.

Procedure: The details of the preparation of beds for anesthetized patients vary considerably, but two methods that are very commonly used are as follows:

Method 1. Arrange the protector, under sheet, rubber, and draw sheet as when making a closed bed.

Put a bath blanket lengthwise across the bed with its lower edge across the foot of the mattress. Tuck it in on both sides.

Place the ether rubber across the head of the mattress. Cover this with the ether slip or a folded sheet (this should cover about eighteen inches of the mattress and extend an equal length beyond it at the top), tuck it in on both sides, and with mitered corners at the top.

Put a bath blanket, the upper sheet, the two bed

[1] A strip of rubber the width of the bed and about sixteen inches long, unless the rubber under the draw sheet is narrow, when it must be longer, for the two rubbers must meet and the ether rubber extend to the top of the mattress and the other one to the level of the patient's knees.

[2] A hemmed strip of white muslin about two yards wide and one yard long.

[3] Pieces of gauze about three inches square.

blankets and the spread in position and tuck them, except the bath blanket, under the mattress at the foot of the bed; put the bath blanket just enough over the upper edge of the foot of the mattress to keep it in place, but not enough to make it necessary to undo the other clothes when it is removed. At the top of the bed fold the spread back under the bed blankets, and turn the end of the sheet over it. Fold these clothes, not the bath blanket, down to the foot of the bed. The fold made should not be more than nine inches wide, so that it will not be in the way when the patient is lifted into bed.

Put a hot-water bag in the center and another at the foot of the bed under the upper bath blanket. Put the nightgown over the one in the center so that the gown will be warm if it is required.

Arrange the pillows. The various methods of doing so will be given after the description of method 2.

Put the kidney-basin, towel, mouth-wipes, bag, and tongue depressor on a table, and this where it will be out of the way of the stretcher.

Place the shock-blocks under the bed near the foot, or, if the patient is to be placed in the prone or Fowler's position, the head.

Method 2. The only difference between methods 1 and 2 is the arrangement of the bath blankets; therefore, arrange the underclothes as far as, and including, the draw sheet, as in Method 1, also the ether rubber and slip[1] and the upper covers, except the bath blanket.

[1] If the patient is to be placed in the prone position it will be better to arrange these blankets so that the opening will be on one side, instead of in the center, preferably the side to which the stretcher will be brought.

After you have turned down the upper covers, double both of the bath blankets and place them so that one will cover the upper and the other the lower half of the bed. Put one hot-water bag in the center of the upper blanket (place the night-gown on this) and the other, near the bottom of the lower blanket. Turn up the sides of these blankets so that the edges lap down the center.[1] As will be seen in Demonstration 14, when the patient is put into bed, the upper blanket is wrapped around the trunk and the lower one around the legs.

The manner of arranging the pillows will depend upon the position in which the patient is to be placed, and this will be governed by either the condition of the patient or the nature of the operation. Sometimes after operations upon the brain or skull the patient is put in what is known as *Fowler's position* in order to limit oozing; this position is also often used after operations upon the chest to facilitate drainage, and either it or what are known as the *prone position* and the *lateral position* is used after operations for septic conditions of the abdomen. If the patient is suffering from shock,[2] she is placed on her back without any pillow under her head and the foot of the bed is raised in order to favor the flow of blood to the brain. When there is no need for any of the positions mentioned, the patient is placed either with one pillow under her head, or a common

[1] Even when the patient is to have a pillow or pillows under her head it is well to use the ether rubber and slip, because if she is in poor condition or very nauseated it may be necessary to remove the pillows.

[2] See Chapter xviii.

custom is to leave the pillow out until the patient recovers consciousness and then, if she is in good condition and desires it, give her one. The main reason for the omission of the pillow is to favor the flow of blood to the brain.

When a pillow is not put under the head it is usual to stand one at the head of the bed to prevent the patient knocking her head against the bars. This

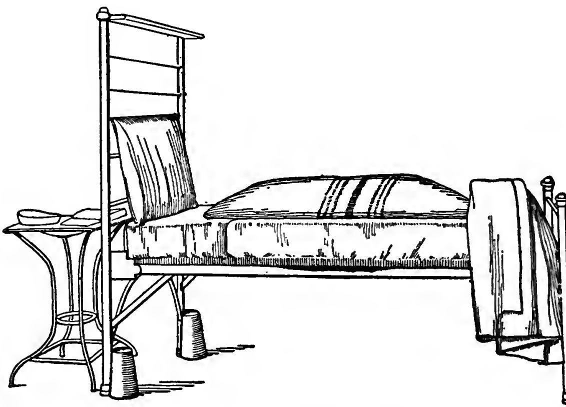

Fig. 3. Anesthetic Bed.

is particularly necessary when the foot of the bed is raised. To keep the pillow in place either pin the case over a bar of the bed as in Fig. 3, or, if there is no horizontal bar, or the pillowcase is not wide enough to be so pinned, envelop the pillow in an ether slip or draw sheet, stand the pillow in position and pin the side ends of the slip together at the back of the bed.

A pillow is sometimes placed lengthwise at one side of the upper part of the bed, with the opening of

the case toward the foot. This is to put behind the patient's head and slightly under one of her shoulders, so as to help to keep her head turned on one side. The reason for this will be found in Demonstration 14. It can be used either with or without a pillow under the head. In the former case put a portion of the lengthwise pillow under one side of that intended for the head.

The arrangement of the pillows for the prone position in which, as the name signifies, the patient lies prone, consists in placing one pillow where her head will rest and the other where it will be under the lower part of her chest (not the abdomen). If the bed has been made according to Method 1, place the pillow for the chest between the two bath blankets; if according to Method 2, under the blanket covering the upper half of the bed.

For Fowler's position the pillows are not put in place until the patient is in bed; therefore the description of their arrangement will be left until Demonstration 14. In actual practice, however, twine and the appliances necessary to prevent the patient slipping down in bed (see Demonstration 13) must be brought to the bedside and piled in convenient order as soon as the bed is made.

Fracture Bed

The only difference between a **fracture bed** and an ordinary bed is that a perforated board the size of the wire foundation is placed over the latter in order to prevent any motion at the point of fracture by sagging of the mattress.

Demonstration 8

Making a Bed with a Patient in it, including Washing and Rubbing the Back

Requisites: A dressing basket,[1] a dressing basin containing warm water, washcloth, necessary clean linen. Pile the linen in the order in which you will need it.

Points to be considered in moving the patient:

1. When a patient is very ill, especially when her heart action is rapid or weak, moving must be done without her assistance.

2. It is often important that a patient be moved as little as possible.

3. When necessary to lift a patient's buttocks when passing a sheet under her (unless she is too weak or has some injury of the legs) flex her knees and have her feet upon the bed. When in this position she can usually help to raise herself and, even if she is unable to do so, it is much easier to lift her if her thighs are raised, as they are when her knees are flexed.

4. When lifting a patient's shoulders, support her head. To do this, bend your elbow slightly, pass your arm behind the patient, place your hand firmly under far shoulder, with your fingers in the

[1] A dressing basket usually contains: Alcohol or other bathing lotion, a dredge of talcum powder, a tube of tooth paste, a bottle of mouth wash, a small cup or glass, wooden applicators covered at one end with absorbent cotton (used for cleaning the teeth and mouth) small paper bags for the reception of soiled mouth-wipes, nail brush, nail file, orange sticks, soap, comb, whisk, dressing rubber, and, in hospitals where its use is frequently required, a small bottle of delphine.

axilla, and let her head rest in the bend of your elbow. See Fig. 4. When passing your arm behind the patient raise her head with your free hand.

5. Do not attempt to move a patient until you are sure that there is nothing to hamper her movements.

Fig. 4. Method of Supporting Head and Shoulders while Adjusting Pillows, etc.

6. When two or more persons are moving a patient, they must work in unison, and in order to do so one must take the lead and give necessary directions and the word to move when all is ready.

Order of procedures in making the bed:

1. Be sure that everything necessary for the work is at hand and arrange the table and chairs, as in Demonstration 4, for the reception of clothes taken from the bed.

2. Take off the spread, fold it, and put it where it will not get crushed. If there are two blankets on the bed, remove the upper one.

3. Loosen the bedclothes on all sides. To do so, raise the mattress with one hand and draw the clothes out with the other, so as to avoid risk of jarring the patient and tearing the clothes.

4. Change the top sheet if necessary. If it is crushed, but not soiled, it is used for the draw sheet when special draw sheets are not provided.

5. Fold the sides of the blanket and top sheet up over the patient, leaving the fold just long enough to cover her if she is turned. This answers a threefold purpose: it gives a neat appearance; the clothes are not in your way while you work; it keeps the patient as warm as before the upper blanket was removed.

6. Draw the patient to one side of the bed.[1]

7. Take out the pillows, shake them, and, if necessary, change their cases. If the patient does not object to being without them, leave them to air until the bed is made.

8. Rub the patient's knees, heels, and ankles with (a) alcohol, (b) powder and then, if possible, turn her on her side; in any case, loosen her nightgown, wash her back with soap and water, including her axilla, shoulders, and thighs, rub these parts with (a) alcohol, and (b) powder.

9. Change the nightgown if it is soiled, if not brush all crumbs from it and fasten it. Brush crumbs from under the patient, using the hand (*always use the hand under the patient, for only with it will all crumbs be discovered*), and turn her on her back.

[1] When possible, this should always be done when making beds, giving baths, or other treatments the nature of which does not prohibit it, for the change of position is usually agreeable to the patient and it makes it less necessary for the nurse to stoop and facilitates the carrying out of many of the details of her work.

10. Sweep all crumbs from the bed on the side at which you are standing, using either a small whisk or a folded towel. Do likewise on the other side of the bed when you go there to adjust the sheets. *Look for crumbs between the sheets.* This procedure should be carried out even when the sheets are to be changed, for otherwise the crumbs may be scattered on the mattress.

11. Change the under and draw sheets, if necessary; if not, arrange them as described on page 46.

12. Draw the patient over to the center of the bed.

13. Arrange the upper sheet and blankets in position. Have the upper edges of the blankets under the patient's chin and leave enough of the sheet to turn eight inches over the blanket. Tuck in first the top sheet and then the blankets at the foot, being careful to keep them, especially the sheet, loose over the patient's feet, as directed in Demonstration 6.

If the weight of the clothes is uncomfortable, support them on a cradle. Tuck these covers in at the sides for a short distance, about twelve inches, mitering the corners of the sheet, but folding those of the blanket so that they make a sharp edge along the corner edges of the mattress.

14. Replace and arrange the pillows so that the patient lies comfortably.

15. Put on the spread. Arrange it at the foot and sides as when making a closed bed, but fold it back under the blankets at the top and turn the sheet over it.

(N. B. These details should be carried out in the order in which they are given, since, if there are crumbs

in the upper clothes, nightgown, or pillows, they are likely to be left in the bed if these articles are changed after the under sheets.)

16. Remove all soiled clothes and the appliances used for the work. Replace anything that has been moved from its regular place. Be sure that the surroundings are in order and that the patient is comfortable.

Methods of carrying out details of procedures[1]:

To move a helpless patient to one side of the bed: If alone and *the patient is small*, pass one arm under the upper part of her back and the other under her thighs and draw her toward you.

If the patient is tall, put one arm back of her neck and far shoulder and the other under the small of her back and move the upper part of the body; then slip one arm under the small of the back and the other under the knees and move the lower portion of the body. It may be necessary to repeat the procedures once or twice in order to get the patient as far over as required, but it is not essential to carry them out in the same order; in fact, it is better to move first the part of the body by which you are standing.

If the patient is very ill and heavy, assistance should be had if possible. In such case, support the patient's head and shoulders with one arm and slip the other arm under the small of her back. Have your assistant stand beside you and pass one arm under the upper part of the patient's thighs and the other under her knees. Draw the patient toward you.

[1] It is well for the pupils to become fairly expert in carrying out each of the procedures here described before they attempt to make the bed, for their attention will then be better focused on the mastery of each procedure.

To turn a patient on her side: *To turn a weak or helpless patient toward you,* slip one arm under her far shoulder and obliquely across her back, so that your hand comes under the side nearest you; pass your other arm under her hips, also from the far side, raise her slightly, and, drawing her somewhat backward, turn her toward you. (See Fig. 5.) It may be

Fig. 5. Turning Patient.

necessary to make some change in the position of her shoulders or hips. If so, to move her shoulders, place your arms, one on either side, around her body with your hands under her lower arm, raise her slightly, and move her as required. Have the pillow under her head while doing this. The hips can be moved in the same manner.

A heavy patient is usually more easily turned by loosening the draw sheet on one side and, reaching over the patient, grasping the loosened end of the

sheet on a line with the patient's shoulders and thighs, and, by pulling it upward, turn the patient.

If the patient is not helpless all that is usually necessary is to place one hand on her back between the shoulders and the other behind her thighs, passing your hands behind her on the side farthest from you and press upward.

To turn a patient from you, slip one arm under her shoulders from the near side, getting your hand as far as possible under her far side. Pass your other arm under the hips until your hand comes well under the far thigh. Raise her somewhat and, drawing her slightly backward, turn her.

N. B. *In doing work of this kind, when necessary to bend forward, bend your knees and hips, never your back.*

Method of changing the upper sheet: After loosening the bedclothes and removing the spread and blanket, place a clean sheet over the one that remains; cover this with a blanket; turn about ten inches of the sheet over it at the top; if the patient is not too ill she can usually be asked to hold the upper edge of these, otherwise they can be tucked under her shoulders or under the pillow to retain them in place; then, standing near the foot of the bed, pass your hand under the clean sheet and take the covers that are to be removed near center and draw them out. Never expose the patient while doing this. Separate sheet and blanket and place them across the chairs.

To wash the back: If possible have the patient on her side; if she is weak turn her toward you as you can then support her with one arm while you work. Turn back the upper corner of the bedclothes enough to have them out of your way but not enough to expose the patient unnecessarily. Protect the bed

by putting a small rubber covered with a towel close to the patient. Begin the work at the neck and shoulders, wash first with soap and then with clear water. Use the towel covering the rubber to dry the patient.

If the patient cannot be turned on her side you should, if possible, have an assistant and make her stand on the side of the bed opposite you and, by putting her hands behind a small part of the body raise it slightly upward from the bed while you, with the moist washcloth in the center of your hand, fixed so that its ends will not drag on the bed, pass your hand under and wash as much as you can, then dry this part, rub it with alcohol and powder as described in the paragraph following. Begin to work at the shoulder nearest you and proceed in like manner until you have finished all this side of the back, then pass your assistant the necessary utensils and have her do the washing, etc., while you hold the patient. If you cannot get an assistant, raise the parts with one hand and work with the other proceeding in the manner just described.

N. B. *It is to be remembered that when a patient cannot be turned, washing and rubbing the back is even more important than when she can, as there is then often great danger of pressure sores.*

To rub the back: Pour a little alcohol on your hand and rub it on the back around the shoulders and neck, then place your hand firmly on the skin and move the flesh on the bone, repeat until you have gone over the entire back and hips; pay special attention to any parts that look red. Pour a little powder on your hands and rub it over the back; do not use much.

To change the pillows: Slip one arm under the patient's neck and far shoulder, letting her head rest on your arm (see Fig. 4); raise her slightly and with your free hand remove the pillows, pulling them outward. It is usually easier to remove them one at a time. Before replacing the pillows, shake them and see that their corners fit into those of the cases. Do not let them rest on the bed while doing this. To replace them, put them one on top of the other, at the head of the bed close to, but on the far side of, the patient; raise the patient as when removing the pillows; pass your hand back of her and, taking hold of the lower pillow, draw them into place. Arrange them so that the patient rests comfortably. Do not allow an unconscious or helpless patient's head to be thrown forward on the chest, for such a position will interfere with proper breathing.

To change the nightgown.—Important points to remember when doing this are:

When a patient is weak or helpless, if the sleeves of the gown do not slip off readily, slip one of your hands through an armhole, grasp the patient's arm about the elbow, and, bending it slightly, draw it backward while, with your other hand, you pull the sleeve either at the armhole or the wrist.

Get a weak patient's arm into the sleeve of a gown by putting your arm through the lower opening, grasping her hand, including her thumb, and drawing the arm through the sleeve.

If an arm is injured, remove the sleeve from that arm last, but put the sleeve of the clean gown on it first.

Be sure that the gown is well pulled down and free from creases. If the gown opens down the back,

it is usually better, especially if the patient is weak or helpless, not to put the lower ends under her as they are likely to become wrinkled.

Procedures in changing the nightgown:

Method 1. If the gown opens down the back, remove one sleeve of the gown to be discarded and put on the corresponding sleeve of the fresh one. Slip the fresh gown across the chest, under the soiled one, to prevent exposure, and change the sleeves in the same way as the first ones.

Method 2. To remove a closed gown, have the patient lie on her back with her knees flexed; pull the gown up as far as possible, then, if the patient is strong enough, have her raise her thighs slightly; if she is not sufficiently strong, place one of your hands under her buttocks and raise her while you draw up the gown with the other hand, raise her shoulders if necessary. When the gown has been gathered up to the shoulders, slip one of your hands through the upper armhole of one of the sleeves, grasp the patient's arm below the elbow, bend it slightly while, with the other hand, you draw off the sleeve; slip the gown over the head and off the other arm.

The best way to put on the gown depends upon its make. If it is narrow at the top and does not unbutton it can sometimes be put on most easily in about the same manner as the soiled one was removed except that the order of things is reversed; thus one arm is drawn into a sleeve, then the gown is put over the head and the other arm drawn into its sleeve and the gown pulled down, raising the patient while doing so in the same manner as when removing the gown.

Method 3. If the gown is loose at the top and the opening is a fair size, it is best put on by gathering

it up loosely and slipping it over the head and then drawing first one and then the other arm through a sleeve. The gown is pulled down as in Method 2.

To arrange the under and draw sheets when they are not changed: Tuck them and the rubber in on one side, tucking in about sixteen inches more of the draw sheet than you leave for the other side.

Go to the other side of the bed, brush out the crumbs, turn the draw and rubber sheets back over the patient (that they may be out of your way while you adjust the under sheet) with, if they are wide, their upper ends turned downward so that they will not come near the patient's face. Stretch and tuck the under sheet in as in Demonstration 6. Do likewise first with the rubber and then with the draw sheet.

Methods of changing the under sheet and draw sheet:

Method 1. After the clothes have been loosened, and other preliminaries attended to in the order previously described, draw the patient to the side of the bed, and, if possible, turn her on her side.

Go to the opposite side of the bed.

Turn back the draw sheet and rubber, as described above.

Roll one side of the under sheet close to the patient's side.

Gather one side of the fresh sheet to about its center (let it rest on a table or chair while doing so, not on the patient's bed) and place the gathered portion next the roll of the soiled sheet. *Be sure that the sheet is perfectly straight and that you are leaving an equal amount to tuck in on both sides.*

Tuck in the sheet on the side at which you are standing.

Tuck in the rubber on this side.

Treat the draw sheet in the same manner as the under sheet with the exception of leaving it longer at one side than the other.

Turn the patient and draw her on to the finished part and go to the other side of the bed.

Remove the soiled sheets.

Stretch the under sheet until it is perfectly free from wrinkles and then tuck the side and ends under the mattress in the same manner as when making a closed bed.

Treat the rubber and draw sheet in the same way.

Method 2. *When it is undesirable to move a patient,* it is often easier to change the bedclothes from the top downward. To do so will require two workers, who should stand on either side the bed, opposite each other. *It is particularly important that they work in unison,* one never attempting to raise the patient until the other is ready and each one moving the sheets an equal distance.

Loosen the clothes and carry out all other necessary preliminaries.

Leave one pillow under the patient's head.

Draw the soiled sheet down to the lower edge of the pillow.

Gather the fresh sheet from the bottom upward, leaving enough free to cover and tuck under the top of the mattress (about eighteen inches).

Pass this sheet under the pillow from the top, see that it is perfectly straight, and tuck the end under the mattress so that the sheet will be held in place. Let the nurse whose left arm is nearest the head of the bed pass her arm under the patient's shoulders and the other nurse slip her left arm under the small of the back.

Raise the patient as much as, but no more than, necessary, and with your right hands draw first the soiled and then the clean sheet down as far as the rubber. Lower the patient.

Roll the rubber and draw sheet tightly to the patient's side and let each nurse grasp the roll of rubber directly opposite the other and lift together; pull down both under sheets as far as possible. Lower the patient. Repeat procedures as often as necessary until you reach the knees, then one nurse raises the legs while the other removes the soiled sheet and draws the clean one into place.

To change the draw sheet: Gather the clean sheet loosely in the center, leaving the ends for the top and bottom free. Pass it under the small of the back. Be sure that it is straight.

Let each nurse pass her left arm under the patient's back, a slight distance apart, and raise her slightly, and then let each, with her right hand, draw the soiled sheet down under the border of the clean one, secure it under the mattress so that it will not be pulled up with the clean one, and draw the latter up as far as necessary. Secure its corners under the mattress to prevent it being pulled out of place.

If possible, flex the patient's knees and let each nurse pass her left arm under the patient's thighs, a slight distance apart and raising the patient slightly with her right hand, draw both soiled and clean sheets down as far as possible. Lower the patient. Repeat the procedure if necessary.

Let one nurse tuck in, separately, the under sheet, rubber, and draw sheet on her side and then pass her arms under the patient's back and thighs and raise her slightly and the other nurse stretch each article

separately until it is free from wrinkles and tuck it under the mattress in the usual manner. Arrange the under sheet at the top and bottom.

Demonstration 9

Methods of Changing a Mattress with the Patient in Bed

There are several ways of doing this. Method 1 as here described is to be preferred when the patient is very ill, but it needs at least three people and it may require five or seven; also, it cannot be used if the bed has a high foot-piece.

Requisites: In addition to bed and ordinary bedding a mattress and small pillow.

Method 1. Remove the spread, fold it neatly, and hang it where it will not get crushed.

Take off the upper blanket and hang it over the back of a chair, being careful that its ends do not touch the floor.

Fold the sides of the upper sheet and remaining blanket back over the patient, turn the bottom part of this fold under her legs.

Remove the pillows and substitute a small pillow or folded sheet.

Loosen the lower sheets and bring the center of the upper edge of the under sheet over the pillow around the patient's head and its corners down with the sides. This will prevent the pillow falling out when the patient is lifted.

Roll the sides of the lower sheets, including the rubber as tightly as possible; roll side upward, until the rolls touch the patient on each side. Tie the

bottom of the rolls around the patient's feet and ankles. This prevents the clothes falling and getting in the way when the patient is lifted.

Take hold of a roll close to the head and below the knees, have your assistant do likewise on the other side.

Lift the patient from the bed.

Have the second assistant pull out the mattress from the foot of the bed and shove in the fresh one. She must have the fresh mattress ready and have hold of the one that is to be removed and be ready to pull it out the instant the patient is raised.

If the patient is tall or heavy, there will have to be two or three lifters on each side of the bed.

The ordinary mattress can be changed for an air mattress in this way. The fracture board, which it is necessary to have under the air mattress, is slipped in before the mattress.

Method 2. Leave a pillow under the patient's head, otherwise proceed as for Method 1 as far as, but not including, rolling the under sheets to the side of the patient; have your assistant make a triangular fold in these at the top and turn them over the patient[1]; then, by pulling these sheets on your side, draw the patient toward you, to the edge of the mattress. If the patient is tall or heavy, have your assistant come around and help you do this. Fold and turn the ends of the sheets on this side over the patient in the same manner as on the other side.

Go to your assistant's help and, together, draw the mattress to her side of the bed until at least half of the wire mattress is exposed.

[1] They are turned back in this manner to keep them out of the way when the mattress is moved.

Cover the latter with a fresh mattress; draw the patient on to this by making traction upon the under sheets. If it is necessary for your assistant to come to your help she should first place a chair or stool under the free end of the mattress, on her side.

Have your assistant remove the mattress that is to be discarded.

Place a support under the free end of the fresh mattress, go to the other side of the bed, and, with your assistant, draw the mattress into place.

Go, with your assistant, to the other side of the bed; put one arm under the pillow and the other under the patient's back; have your assistant put one arm under her thighs and the other under the knees and draw the patient to the center of the bed.

If the under sheets are to be changed, arrange them on the vacant half of the mattress before drawing the patient over.

Arrange the clothes as usual.

Method 3. When the patient is of light weight or can help herself, one nurse can easily change the mattress in much the same way as by Method 2, but with the following differences:

Place two heavy chairs or stools on each side of the bed.

As the patient's movements are not to be hampered do not turn the upper covers under her feet.

Instead of turning the lower sheets over the patient, after you turn back the sides of the upper covers over her on each side, fold the sides of the lower sheets on the mattress. On the side to which you intend to draw the patient first make the fold about two inches from the edge of the mattress and, as the patient may lie on part of this fold for a short time, have it

very smooth and flat; on the other side make the fold as close to the patient as possible.

Flex the patient's knees, have her place her feet and the palms of her hands firmly on the bed; put one of your arms under her head and the other under the buttocks.

Fig. 6. Changing Mattress.

Have the patient raise herself and, if possible, move toward you as you draw her forward.

Go to the other side of the bed and draw the mattress until at least half of the wire one is exposed.

Place the chairs so that they will support the free end of the mattress while you go to the other side and place as much as possible of the fresh one on the exposed springs and arrange the chairs to support the remaining portion.

Standing between the two chairs, lean forward and draw your patient over as before.

Go to the other side of the bed, remove the old

mattress and draw the fresh one into place. Proceed as in Method 2.

Method 4. If the patient is not able to help herself as much as required in Method 3, fold the under sheets on *both* sides as close to her as possible and draw her from one mattress to the other by making traction on the sheets. Otherwise proceed as in Method 3.

Demonstration 10

Turning the Mattress

Requisites: Same as for Demonstration 9, but substitute three pillows for the extra mattress.

A mattress can be turned in the same way as it is changed with the following exceptions:

In **Method 1**, after raising the patient and removing the mattress turn it and slide in first the part that was formerly at the foot of the bed.

In **Methods 2 and 3,** after drawing the mattress to one side of the bed, cover the exposed wire with three pillows and draw the patient on to these. Then turn the mattress, *turn it from top to bottom* for the patient may fear that it will fall upon her if it is turned from bottom to top. After drawing the patient on to the mattress, remove the pillows, draw the mattress into place, and proceed as when changing the mattress.

CHAPTER III

Moving, Lifting, and Carrying Patients

Important points to be considered in moving, lifting, and carrying patients. Moving a patient up in bed. Lifting a patient into a sitting position in bed. Lifting a patient from a stretcher to the bed and vice versa. Arrangement of an anesthetized patient in bed. Fowler's prone and lateral positions. Moving a patient from one bed to another. Carrying a patient. Lifting a patient from the bed to a chair and vice versa.

Important Points to Consider when Moving, Lifting, and Carrying Patients:

1. Before lifting a patient from the bed draw her to the edge in order to minimize the necessary degree of stooping.

2. When stooping is unavoidable, bend the knees and hips and keep the shoulders thrown back; *do not bend the back, especially when you have a weight on your arms.*

3. When lifting or carrying a patient do not let her put her arms around your neck, but have her put them across your chest and back (under your arm nearest her) and clasp her hands on your far shoulder. More weight is thus thrown on your shoulder, and less upon your back; the shoulders are not easily strained by a weight and the back is.

4. Before lifting a conscious patient, tell her to

hold herself as stiffly as possible while you are lifting and carrying her.

5. Before moving a patient be sure that there is nothing (*e. g.*, the bedclothes) to impede her movements.

6. If a patient is to be carried, before lifting her,

Fig. 7. Carrying Patient.

see that there is no obstruction between you and your goal.

7. When two or more persons are lifting or carrying a patient they must lift in unison, and in order that they may do so one must take command, giving directions and the word to lift and to start when *all* are ready.

8. When two or more persons are carrying a patient in their arms they should step in unison,

but not with the same foot; *i. e.*, when one steps with the right foot her neighbor should step with the left.

Demonstration 11

To Move a Patient up in Bed

Method 1. Flex the patient's knees so that her feet will rest firmly on the bed. Pass one of your arms behind her and, supporting her head in the bend of your elbow, grasp her under her far arm. Put your other arm under her thighs.

If the bed is supplied with a *pulley*, have the patient grasp this; if it is not, have her place her hands, palms downward, firmly on the bed and, in either case, have her raise herself slightly while you draw her upward.

Method 2. If the patient is heavy and cannot help herself it will require two nurses to move her and, unless the bed is a wide one, it is better to stand on opposite sides.

If possible, flex the patient's knees, even though she cannot help herself; grasp her under the far arm as when lifting her alone and place your other arm under her back. Have your assistant place one of her arms near yours and the other under the patient's thighs or, if the latter's knees are not flexed, under them.

Method 3. Loosen the draw sheet and, if the patient is heavy, the rubber. Roll these to the patient's side. Take hold of the roll about on a line with her shoulders and thighs; have your assistant do likewise on the other side, taking hold of the roll directly

opposite you. Move the stretcher thus made, and with it the patient, upward.

If necessary, draw the sheet down afterward in the following manner:

Pass your arm nearest the head of the bed under the patient's back, while your assistant, from the opposite side, does likewise a little lower; raise the patient slightly. Each, with your free hand, pull the upper part of the sheet into position; lower the patient. Then, if necessary, each pass an arm under her thighs and, raising her, adjust the remainder of the sheet.

Tuck the sheet under the mattress on one side; have your assistant stretch and tuck it under on the other side.

Demonstration 12

To Sit a Patient up in Bed

Important points to remember in doing this are:

1. When a patient is weak, especially when she sits up for the first time after a serious illness, she may feel faint and should therefore be supported while the pillows are being arranged.

2. A weak patient should be well supported while sitting up and the pillows should be so adjusted that they will provide a rest for her arms and fit into the curve at the neck and that at the waistline. Also, means should be taken to prevent her slipping down in bed.

3. Except in very hot weather, a wrap should be put about the patient's shoulders.

Requisites: Back rest, six or seven pillows, shoulder wrap, knees support, twine.

Procedure:

Method 1. If the patient is on a Gotch bed all that is required is to raise the portion of the iron frame under the mattress which acts as a back rest and, if needed, the adjustable portion under the knees and to arrange the pillows in about the same manner as when a back rest is used.

When the bed is not provided with an adjustable frame a back rest is substituted and with this, when the patient is fairly strong and able to move at will, she can usually be made comfortable if the rest is covered with two pillows. If she is weak, however, it will require about four pillows, with a canvas covered rest, and five, with a metal or wooden rest, to support her properly; an extra one will be needed if it is necessary to prevent her slipping down in the bed.

Method 2. Proceed as follows: Arrange back rest, pillows, and shoulder wrap where you can reach them and pile them in the order in which you will need them.[1]

Move the patient up in bed if necessary.

Pass your arm nearest the head of the bed behind her in the same manner as when changing the pillows; if necessary and possible, have the patient place her hands palms downward on the bed and, by pressing upon them, help lift herself as you raise her into a sitting position.

If she needs to be supported, pass your other arm

[1] If the patient is so weak or heavy that one nurse cannot do this alone the assistant should stand on the opposite side of the bed and pass one arm behind the patient's head and far shoulder, placing her hand in the axilla, and pass her other arm behind the back and raise and support the patient while the pillows are being arranged.

across her chest and, if necessary, let her head rest against your shoulder.

Remove your arm from her back. Put the wrap about her shoulders. Put the rest in position and make sure that it will remain in place.

If the rest is of wood or metal, place a stiff pillow upright against it, but if the back of the rest is of

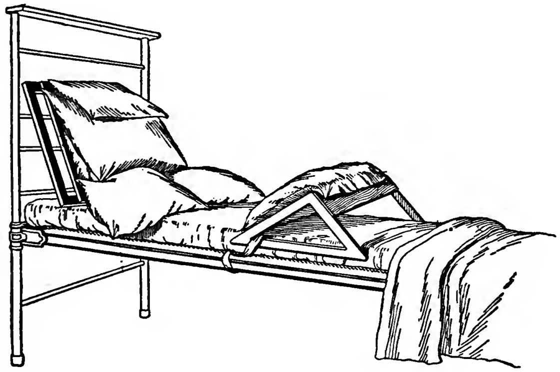

Fig. 8. Arrangement of Pillow and Knee Prop to Support Patient Sitting up in Bed.

canvas, this pillow can be omitted, for the soft pillows do not slip on the canvas as readily as they do on the smooth foundations.

Place a soft pillow obliquely on either side of the patient in such a manner that a corner of each pillow will fit into the curve at the patient's waist, and the remainder afford a support for her arms; place another soft pillow against the rest (or hard pillow) to support the patient's back and one above this for her head.

Patients who are troubled with dyspnea are fre-

quently obliged to sit up in bed continually and often like to lean forward at times. To provide for this, place a small bed table covered with a pillow in front of the patient.

To Prevent a Patient Slipping Down in Bed

The means usually employed to prevent a patient slipping down in bed are: (1) Putting a support under the knees; (2) putting a brace at the feet; (3) providing a support for both knees and feet.

The support under the knees serves also to relax the abdominal muscles, which is often desirable.

The *Meinecke non-slipping knee and thigh brace* is probably one of the best appliances to use for such supports, for, even when its shape is not quite adequate for the occasion, it can usually be made so by the adjustment of pillows or pads. The brace has rough rubber pads on its under surface which inhibit its slipping; these are not sufficient, however, if the patient is heavy and, in such a case, pass a cord of heavy, white twine through the brace, and tie it first to the sides of the bed on a line with the brace (putting it through interstices of the wires of the spring as well as around the side bars), and then to a bar at the head of the bed, on a line with the mattress. Cover the top of the support and the side under the patient's thighs with a pillow, which is protected with a rubber or pad put on under the pillowcase.

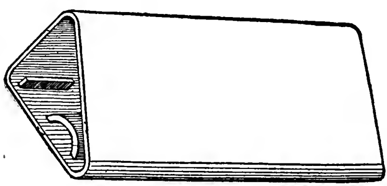

Fig. 9. Knee and Thigh Support.

The same kind of brace, retained in place, if necessary, in the same manner can be used at the feet.

In some hospitals a similar appliance made of bars of wood is used (see Fig 9). It is covered and held in place in the same way as the Meinecke brace.

When there are no such appliances as those mentioned to be had, a brace can be improvised in one of the following ways:

Method 1. Double a pillow (protected with a quilted pad or a rubber case under the white case) over a cord of heavy white twine, tie the pillow if necessary.

Place it under the knees or at the feet as required. Pass the cord on each side through interstices of the wires of the spring and around the bar of the bed on a line with the pillow and then stretch it upward and tie it at the head of the bed on a line with the mattress.

Method 2. Put a pillow in a quilted pad or rubber case and then place it in the center of a sheet that is folded diagonally.

Put the pillow under the knees or at the feet, as required, and tie the ends of the sheet to a bar at the head of the bed.

Demonstration 13

To Move a Patient from the Bed to a Stretcher

In preparation for this demonstration, the pupils should read, or be told, something of (1) the local conditions existing when there is pus in any of the abdominal organs; (2) the dangers of rupturing walls or adhesions which may be localizing the infection

and of the consequent peritonitis. The fact should be emphasized that such rupture may occur if the patient makes strenuous movements and that, therefore, when a patient is suffering from any septic abdominal infection, she is not to be allowed to assist when being moved from the bed to the stretcher.

Requisites: two blankets besides those on the bed, shoulder wrap, stretcher.

Procedure: Replace the bedclothes with a small blanket as described below.

Draw the patient to the side of the bed and flex her knees.

Draw the stretcher close to the same side.

Stand on the free side of the stretcher and, reaching across it, pass one arm under the patient's head and shoulders and the other under the upper part of her thighs. Draw her over on to the stretcher.

If the patient is heavy or is not able to help herself it may require two to move her. In such a case put one arm under the small of her back, instead of under her thighs, and have an assistant put one arm under the thighs and one under the knees.

After the patient is on the stretcher, cover her with the other blanket[1] and tuck this under her along the sides and at the feet.

Put the wrap around her head and shoulders. (This is sometimes omitted when the operating room is near the ward.)

[1] In cold weather a large thick blanket which can be doubled is used for this purpose. The one put next the patient, on the contrary, is at least partly cotton, for to most people this feels better than wool and the blanket is not so easily injured by the frequent washings that its use necessitates as a woolen one would be.

To replace the bedclothes with a blanket[1]**:** Fold the blanket in four,[2] if it is not, as is usually the case, already so arranged.[2]

Put it across the chest with the free ends facing the head. If the patient is well enough she can usually be asked to hold one of the ends; if not, tuck it under her shoulders or the pillow.

Fig. 10. Replacing Bed Covers with Blanket.

Take hold of the other end between your third and fourth fingers, on either side of, and a little beyond, the patient. Put your other fingers under the bed covers and your thumb on top.

[1] This is a method of replacing the top covers with a blanket that is very commonly used when it is necessary to do this for any purpose, for, if properly performed, it prevents any exposure and, after a little practice, it can be done very quickly and deftly.

[2] If the blanket is a large one, it will be better, when using it to cover a patient on a stretcher, to double it before folding it in four. Usually, blankets kept for this purpose are folded in the way they will be needed before they are put away after use.

Make a fold in the covers about twelve or fourteen inches deep, then, still holding the blanket and with your thumb on top of the covers, pass your other fingers under the upper edge of the fold and repeat the procedure. Repeat as often as necessary to fold the clothes below the patient's feet or to about within twelve inches of the foot of the bed, taking the edge of each new fold with those you are already holding between your thumbs and your first and middle fingers.

If the folded clothes do not come below the patient's feet, put your hand under the blanket and lift them over.

Demonstration 14

To Put an Anesthetized Patient to Bed

In preparation for this demonstration the pupils should read the causes and symptoms of shock and hemorrhage.

Very essential points to be considered in connection with this procedure and the care of the patient immediately following her return from the operating room are as follows:

1. The patient must be lifted carefully and kept quiet; for (a) strenuous movements may cause tearing of stitches or hemorrhage; (b) in septic conditions, movement of the muscles of the affected part may help diffuse the infection, because septic material in the tissues is absorbed chiefly by the lymphatics,[1]

[1] What are the lymphatics? What are the factors controlling the circulation of lymph? If these questions cannot be answered read the sections describing the lymph system in an Anatomy and Physiology textbook.

and absorption and the circulation of the lymph are furthered by muscular movement; (c) in abdominal infections if there are adhesions localizing the septic material, these may be broken down and a general peritonitis thus initiated.

2. The patient must be constantly watched. The pulse should be felt at regular intervals (at least every half-hour after major operations); any change in the color of the skin and character of the respiration[1] must be noted immediately; when the patient is nauseated or restless she is not to be left alone for a second. The emergencies most likely to occur immediately following operation are hemorrhage, shock, and asphyxia. Asphyxia is usually due to obstruction of the air-passages as the result of the tongue falling back over the larynx or of vomitus entering the trachea.

3. The patient must be kept warm and a very important means of doing this is to keep her surrounded with blankets until the diaphoresis induced by the anesthetic[2] ceases. The reason for this being (a) blankets, even cotton ones, are poor heat conductors and thus inhibit loss of heat from the body to a greater extent than sheets; (b) they absorb the sweat and thus prevent rapid evaporation from the skin and the consequent chilling of the body. The two main reasons why it is so important to keep the body warm following anesthesia are: (a) owing to depression of the nervous system, vital body func-

[1] What change will occur as the result of (a) hemorrhage? (b) shock? (c) obstruction to respiration? See section on Symptoms, Chapter 19.

[2] See under Ether and Chloroform, in Materia Medica, the reasons for diaphoresis.

tions are more or less interfered with and thus the state known as *shock* is very easily induced and cold predisposes to such a condition while warmth tends to inhibit it. (b) If the surface of the body is chilled, the skin, blood-vessels, and, if the chilling is at all intense, the muscles will be contracted and the blood thus driven to the interior of the body to such an extent that congestion of internal organs results. As chloroform and ether irritate the respiratory tract and kidneys,[1] congestion of these organs is likely to result in bronchitis, pneumonia, or nephritis.[2]

4. If hot-water bags are left in the bed there is danger of burning the patient, and the worse the patient's condition the greater the danger, because, when the superficial circulation is sluggish, blisters[3] are more readily induced than under normal conditions. If the patient is wrapped in warm blankets she will, under ordinary conditions, be warm enough, and so many anesthetized patients have been burned that it is now a rule in many hospitals that, except in emergency, heaters are not to be left in the bed without a doctor's order. If they are used, observe the following rules:

(a) Fill and cover them as described in Demonstration 7.

(b) Put a layer of blanket between them and the patient.

(c) After a short time, look at the patient's skin

[1] How is it possible for the kidneys to be irritated by the anesthetics?

[2] What is nephritis?

[3] What are blisters? If not able to answer this question read the section on the nature and causes of blisters in the chapter describing the skin in Anatomy and Psychology.

at any part where a bag is in contact, even though the blanket is between skin and bag. If the skin looks red, move the heater, report the fact to the nurse in charge, and rub a little oil or vaseline over the reddened area.

(d) Tell the nurse who relieves you when you go off duty that you have put heaters in the bed and how many.

Requisites for demonstration: Same as for Demonstrations 7 and 13.

Make an anesthetic bed. Have the patient[1] on the stretcher and covered with blankets as in Demonstration 13.

Procedure: This should follow, as far as possible, the usual régime occurring when an anesthetized patient is brought to bed, and as the stretcher is brought near, one pupil should prepare the bed.

To prepare the bed, if it has been made according to Method 1, fold down the upper blanket, keeping the heated side, which is to come next to the patient, innermost; remove the heaters. If the bed has been made according to Method 2, turn down the sides of both the blankets and remove the heaters.

Place the stretcher at right angles with the bed with either the head of the stretcher at the foot of the bed, or the foot of the stretcher at the head of the bed. Or the stretcher can be placed parallel with the bed (but far enough away—about three feet—to allow the lifters to turn) with the patient facing the head of the bed.

To lift the patient: The lifters—three will be required unless the patient is small or of light weight—all stand on the same side of the stretcher, between

[1] It is well that this should be a pupil.

bed and stretcher. All pass your arms as far under the patient as possible, tilt her slightly toward you. Do not lift until your backs are straight, your shoulders thrown back, and you are all ready and know exactly what to do. All lift and turn at the same time and walk to the bed.

To arrange the patient in bed in the supine or dorsal recumbent position: If the bed has been made according to Method 1, lay the patient on her back,

Fig. 11. Dorsal or supine position.

take hold of the upper edge of the warmed blanket that was turned down between your third and fourth fingers and the lower edge of the blanket that is covering the patient (and which is now to be removed)[1] between your thumb and first fingers and fold it upward; the edge of the other blanket being between your fingers, it will be drawn upward at the same time; discard the folded blanket, and tuck the upper corners of the other one under the patient's shoulder, draw up the bedclothes. Tuck a towel around her neck and under the edge of the blanket, arranging it so that it will protect the blanket and other covers if the patient vomits. Turn the patient's head on

[1] This blanket is removed, because, as a rule, it belongs to the operating room and, also, it will be damp if the patient is perspiring profusely.

one side. Count the patient's pulse at either the facial or temporal artery, and record its rate and character.

If the bed was made according to Method 2: When the patient is laid on the bed draw the sides of first the upper and then the lower blanket over the patient, under the blanket covering her. Then remove the latter. If the patient is likely to be restless, wrap the lower blanket around her legs and feet, otherwise, draw it so that the opening will be on one side, and arrange it smoothly above and below her legs and feet.[1] Wrap the upper blanket snugly around her neck and chest. The two blankets should meet at about the groin.

Draw up the bedclothes and proceed as already described.

Demonstration 15

Fowler's Prone and Lateral Positions

Nature of Fowler's positions: There are two positions commonly known as *Fowler's position*, being so named after the surgeon who first advocated elevating the trunk in septic abdominal conditions. In one method, the head of the bed is elevated about eighteen or twenty-four inches and the patient lies

[1] This arrangement of the blankets has, under many conditions, certain advantages, viz.: (a) Wrapping the lower blanket around the legs helps to restrain a restless patient's movements; (b) if the patient is raised to a sitting position, the blanket can be kept around her back and shoulders while and after her position is changed; (c) it facilitates giving stimulating enemata, rectal irrigations, etc., without any exposure; (d) the blankets can be removed when they are no longer required without disturbing the regular covers.

in the supine position with knees flexed. In the other, the patient is raised into a semi-sitting position, the knees are flexed and, sometimes, the head of the bed is slightly elevated (about six inches).

Reasons for Fowler's position when abdominal infection exists.[1] (1) The slower the income of the infectious matter the better chance the natural defenders of the body[2] have to overcome it. (2) Septic matter is absorbed chiefly by the lymphatics and there are a great many more lymph vessels and nodes in the upper part of the abdomen, around the diaphragm, than in the pelvis.

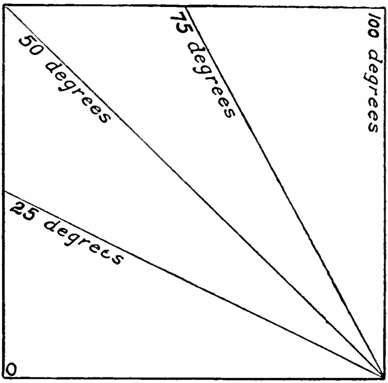

Fig. 12. Diagram to illustrate slants of elevation for different degrees.

(3) The flow of lymph, in all parts of the body, is toward the heart. Because of facts 2 and 3, either elevating the head of the bed or placing the patient in a sitting position tends (a) to inhibit absorption by promoting the drainage of any free septic material to a part of the body that is rela-

[1] Reasons for the use of this position under other conditions were given under Demonstration 13.

[2] What are these? If not able to answer this question, read the sections on phagocytosis and antitoxins in the chapter in Anatomy and Physiology which describes the blood and its functions, or in your textbook of Bacteriology.

tively poorly supplied with lymphatics; and (b) to lessen the rapidity with which the absorbed toxic matter enters the circulation since, with the patient in either of these positions, the flow must be against gravity and it is thus retarded. (4) Flexing the knees tends (a) to relax the abdominal muscles and thus to lessen strain on the wound; (b) it helps to keep the patient from slipping down in bed.

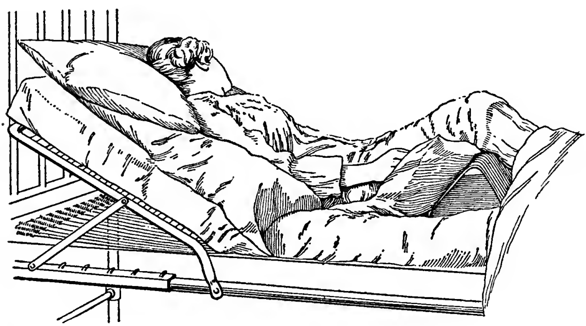

Fig. 13. Fowler's position.

The degree of elevation is a most important point to be considered when putting a patient in Fowler's position; for, in order to secure efficient drainage, between 40° and 50° degrees of elevation is required and, therefore this much must be used, but, as the position is a trying one to a person in the condition that patients usually are when they need to be so placed, a greater degree of elevation than necessary should not be used. Fig. 12 will give some idea of what is meant by 40°. 100° being obtained by sitting the patient absolutely upright, 0°, by lying flat, 40°,

by an incline that would be just two tenths of the distance between 0° and 50°, which would correspond to a line drawn midway between 0° and 100°.

In Fig. 13 the patient's back is resting on an incline that would correspond to 50°.

Nature of the prone position: In this position, the patient is laid prone—*i. e.*, face downward—but

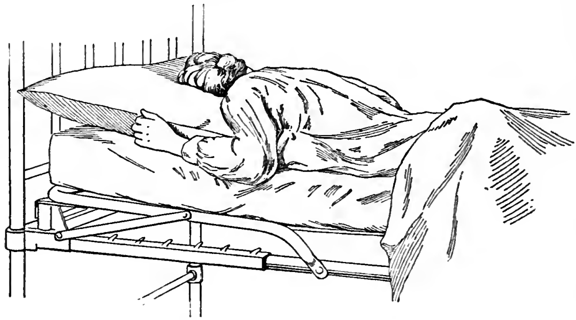

Fig. 14. Prone position.

with her head turned on one side so as not to interfere with breathing, a pillow is placed under the head and one under the lower part of the chest as described in Demonstration 13.

The objects of this position are: (1) To secure drainage of pus to the front of the abdomen where there are even fewer lymphatics and blood-vessels than in the pelvis. (2) To keep pus away from the spine along which there are spaces which are favorable for the formation *of pockets*—*i. e.*, collections of pus and fluid. (3) To facilitate drainage from the wound.

Nature of the lateral position: The patient is placed on the right side, inclining forward, and a pillow is

placed under the region of the liver to, by its pressure, obliterate space in which fluid can collect in the kidney region.

The objects of this position are the same as those desired in the use of the prone position.

Requisites: Articles used for Demonstration 13 and, in addition, those required for sitting a patient up in bed, see Demonstration 12.

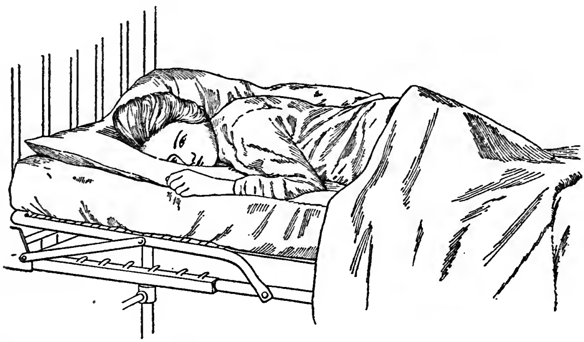

Fig. 15. Lateral position.

Procedure when putting a patient in Fowler's position. Method 1. Place the patient in position on the bed as in Demonstration 13, flex the knees and support them, see Demonstration 12, be sure that the support is securely fastened. Raise the head of the bed on whatever the hospital provides for the purpose.

Method 2. The procedure when placing a patient in the sitting—so-called—Fowler's position is about the same as in Demonstration 12, but, as already stated, it is very important to consider the height to which the patient is raised—this, it will be remembered is to be an elevation of between 40 and 50 degrees

—and, of course, the patient must be very well supported while you are arranging the pillows. If the bed is provided with an adjustable rest, all that it is necessary to do after the patient is laid on the bed, is to turn the lever and raise the frame as required and then place a pillow on each side of the patient to support her arms and, if necessary, a small pillow or pad in the curve at the lumbar region and one behind the head. If there is no such frame, use a back rest and pillows,[1] as in Demonstration 12; and have the nurses lifting the patient from the stretcher hold her in the desired position while you, standing on the opposite side of the bed, adjust the supports. Put these, if the bed has been arranged according to Method 2, under the upper blanket. If the bed has been made following Method 1, a shoulder wrap will be needed; place this on top of the pillows and, when the patient is in place, draw the ends over her shoulders in the same way as, otherwise, the blanket would be arranged. When there is not an extra nurse to arrange the pillows, the one who is to do so should support the patient's legs while she is being lifted from the stretcher, for, as soon as the patient is on the bed, this nurse will be free. Exchange the blankets in the same movement as in Demonstration 14. This can be done either before or after the patient is in position.

Flex the patient's knees and support them in the usual manner. If the patient is heavy a brace at

[1] Even when the hospital is provided with beds with adjustable rests, the pupils should practice putting the patient in position without this help as they may be obliged to do so sometime and it is a very difficult performance with an anesthetized patient. One of the heaviest pupils should act as subject.

the feet will probably be necessary. If required, elevate the head of the bed.

The procedure in putting a patient in the lateral and prone positions is practically the same as for the supine, except that, for the lateral, the patient is placed on her right side, inclining slightly forward and, for the prone, if she is not in this position on the stretcher, she is laid on her side and after the blankets have been exchanged, turned further forward so that she will be lying prone and her head must be turned so that she can breathe easily. If the pillow under the liver region or, for the prone position, that under the chest, is not in the right location one or two nurses, as required, should lift the part of the body where change is necessary while another, standing on the opposite side of the bed, slips one hand under the region of the wound (to obviate danger of pulling the dressing) and, with the other hand, adjusts the pillow. Probably, the easiest way to lift the patient, if she is heavy, will be for each of the lifters to pass her arms around the body getting her hands well underneath. Of course, endeavor should be made to avoid any need for such change since it is most imperative that patients requiring to be placed in either of these positions should be moved as little as possible, even *while they are unconscious*, the reason for this has been already stated.

When the patient is in the lateral posture, it may be necessary, as the head of the bed is elevated to place a brace at her feet, and usually, when the patient's condition is favorable, a pillow is put under her head, but some surgeons prefer that this should be omitted until the patient is conscious and complains of discomfort.

Demonstration 16

To Move a Patient from One Bed to Another

Requisite: An extra bed.

Method 1. This can be used for a convalescent patient.

Remove the top covers except the sheet and one blanket; loosen these at the bottom and sides.

Draw the patient to the side of the bed. Move the second bed to this side and so arrange the sheet and blanket covering the patient that they will cover part of the second bed as well.

If the patient needs assistance, lean across the second bed and draw her over in same way as when drawing her to one side of the bed.

Method 2. Proceed as for Method 1, but loosen the clothes under the patient and draw her over on to the new bed by making traction on these.

If the patient is heavy, have an assistant, if possible, and, both standing on the same side of the bed, draw the clothes at the same time, with equal force.

Method 3. When the beds are of unequal height or when they cannot be placed together the patient may have to be carried and, unless she is light, one or two assistants will be needed. If the beds are in the same room, the distance to carry the patient can be shortened by placing them in the same relative position to each other that the stretcher and the bed were in the former demonstration. Proceed as follows:

Wrap the patient in a sheet and blanket. To do this, remove the upper bedclothes, except the sheet and one blanket. Turn the patient on her side and pass a little more than half of the sheet and blanket

behind and under her and, after turning her on her back, draw them up as far as possible over the part covering her.

Pass one arm under the patient's head and shoulders and another under her back.

Have one assistant pass her arms under the back and buttocks and the other, pass hers under the thighs and legs.

Draw the patient to the edge of the bed; ask her to hold herself as stiff as possible; straighten your backs; remember instruction 8, page 55, decide which foot each one is to step with first; lift in unison and carry the patient to the other bed.

Demonstration 17

To Carry a Patient on a Chair Made with the Hands

When it is necessary to carry a patient any distance, if she is well enough to sit up, an easy way to do so is to carry her on a chair made with the hands.

To do this, put on her wrapper and stockings, see page 79, or wrap her, as just described, in the sheet and blanket, but leave her arms free and put a wrap over her shoulders, and pin it in front to the top edge of the blanket.

Draw her to the edge of the bed; raise and turn her so that she will sit with her legs over the side.

Grasp your left wrist with your right hand and have your assistant clasp her left wrist in like manner.

Both pass your hands under the patient's thighs and each clasp the other's right wrist with her left hand. Have the patient place one hand on your far shoulder and the other on your assistant's.

Demonstration 18

To Move a Patient from the Bed to a Chair and vice versa

Requisites: Chair, two ordinary sized pillows, one small pillow, shoulder wrap, blanket, wrapper or kimono, stockings, slippers.

Arrangement of Chair: If a patient, even though well enough to stand and take a few steps, is weak, or if she must be lifted, the chair is to be placed so that no unnecessary turning or walking will be required. Therefore, place it either parallel with the bed, about two feet from it, facing the head; or else at right angles with the bed, facing you, if it is near the head, or with its back against the bed if at the foot.

Make the chair comfortable with pillows. Unupholstered chairs, such as are used in hospitals, require a pillow in the seat and one at the back, also, a small one to fit into the neck and under the head is desirable, but this last is not put in place until the patient is in the chair. If the chair has not a foot rest provide something that will answer the purpose.

Except in very warm weather, place a wrap to go around the patient's shoulders over the pillows at the back of the chair and another over the pillow in the seat; or, if the patient is to sit out of doors and the weather is cold, put the latter wrap under the pillow, it should be large enough to extend up a considerable distance under the pillow at the back of the chair and to turn up over the patient's feet and to be wrapped around her to above the waist line.

Sometimes a large colored blanket is substituted for the two wraps and it is usually placed cornerwise

with, in order to retain the blanket in place, the top corner hanging over the head of the chair. This corner is turned back behind the blanket after the patient is in position so that the pillow, and not the blanket, will be against her neck. The lower corner of the blanket should be left long enough to turn over the patient's feet and legs to at least the knees.

Preparation of patient: The first time that a patient is taken out of bed she usually wears only a wrapper and stockings.

To put on the wrapper: If it is a closed one, put it on in the same manner as a closed nightgown.

If it is kimono pattern and the patient is not well enough to sit up in bed and slip her arms into the sleeves, spread it out on the side of the bed, under the top covers; draw the patient over until she lies on its back width and put her arms into the sleeves; fasten it in front or the ends may get in the way when the patient is lifted.

Draw the patient to the edge of the bed and put on her stockings.

To put on the stockings: Turn the part of the stocking foot below the heel into the leg of the stocking. Slip the stocking foot over the patient's foot and pull up its leg.

Turn down the bedclothes.

To lift the patient into the chair:

Method 1. If the patient can help herself, raise and turn her so that her legs will be over the side of the bed. Have her put a hand on your far shoulder, put your arm around her waist and support her as she walks to the chair.

Method 2. If the patient cannot help herself, flex her knees. Put your arm diagonally across her

back, placing, if possible, your hand in her axilla. Pass your other arm under her knees. Have her clasp her hands on your shoulder, putting her arms across your back and chest, **not around your neck.** See Fig. 7.

Method 3. If the patient is so heavy that two lifters are required, raise and turn her so that her legs will be over the side of the bed. Stand one on either side the patient. Let one lifter put one of her arms around the patient's waist and one under her knees while the other puts an arm across her shoulders, placing the hand in the axilla, and an arm under the thighs. Have the patient put an arm across each lifter's back and place her hands firmly on their far shoulders.

The lifters should stand on opposite sides of the chair while putting the patient into it.

Put the wraps about the patient and make sure that she is comfortable.

If it is the first time that she is up after a serious illness, or there is any reason why sitting up should affect her heart, count her pulse.

To lift the patient from the chair to the bed:

Method 1. Lift the patient as when taking her from the bed in Method 2, but, as this will be much more difficult on account of the lowness of the chair, be particularly careful to grasp her securely and, before you lift her, tell her to hold herself as stiff as possible. If she is strong enough have her place her feet upon the floor and give herself a slight upward movement as you lift her.

Method 2. If the patient is so heavy that two lifters are required, stand one on each side of the

patient. Take hold of her as when lifting her out of bed according to Method 3. Follow the precautions given in the preceding paragraph and before lifting the patient be very sure of the turns you are to make and see that there is nothing in your way. It is usually better to have the chair parallel with the bed, near the foot, facing the head.

Method 3. When a patient only requires help because of the height of the bed, have her stand against the edge of the bed and place her hands upon it, the one nearest the foot of the bed somewhat further back than the other. Place one of your arms around her waist and the other under her knees. Tell her to raise herself slightly by pressing her hands on the bed and, as she does so, raise her on the side of the bed and then turn her into position.

After the patient is in bed, draw up the covers; take off the wrapper in the same way as you would a nightgown; take off the stockings by slipping your hand through the opening and drawing them down.

If the patient has been up for the first time following a serious illness or if there is any reason why sitting up should affect her heart, count her pulse and record its rate and state if sitting up has any effect upon its character.

CHAPTER IV

Some of the Routine Procedures Incidental to the Comfort and Care of Patients

Essentials for patient's comfort. Methods of making patients comfortable under various conditions. Causes and prevention of pressure sores and chafing. Undressing patients. Care of patients' belongings. Cleansing baths. Care of the hair. Care of the mouth. Methods of giving and removing the bedpan Preparation of patients for the night. Restraining delirious patients. Care of the body after death.

Essentials for Patient's Comfort

Carrying out orders and giving treatments and medication are not by any means all that is essential in the care of patients. The *good nursing* that, when life and death are in the scales, tips the balance in favor of life contains at least two other very essential elements; viz., a prompt recognition of changes in a patient's condition and keeping the patient at rest.

Rest in this instance means that the vital organs, especially the heart, are to be spared all unnecessary effort and, to do this, not only must the patient be kept quiet in bed, but, it is most important, that all excitement, anxiety, and annoyance be prevented. To realize that this is the case recall how the rate of your own heart has been increased when you have become angry, or been frightened, or otherwise ex-

cited. As a matter of fact, the heart action is often accelerated to a greater degree by the nerve impulses arising from such sources than from very active exercise.

Two other points that must be realized in this connection are: (1) That little things which a person would hardly notice, much less be annoyed by, when well may be a source of great irritation to a sick person. (2) That an action which would entail no exertion at all to a healthy person may be attended with considerable effort if performed by a sick one.

Examples of heedlessness on the part of nurses which oblige patients to make unnecessary effort are: (1) Allowing a very ill patient to hold a glass or tube while drinking; (2) not providing a drinking tube of a shape to let the patient suck up the liquid easily in the position in which she is lying; (3) permitting a weak patient to turn or move unaided, or more than necessary, when it is essential to change her position for any reason; (4) not providing sufficient prop to support a weak patient when she is lying on her side or is in other position which it is an effort for a sick person to maintain.

Some of the important things to remember in order to shield a patient from unnecessary anxiety and annoyance are as follows:

1. Give kindly greeting to a patient when she enters the ward or is committed to your care. A patient's idea of the hospital and her consequent readiness to be pleased or displeased, to have confidence in those to whom she must trust herself or fear of them, is often based upon her first impressions and these, usually, are chiefly made by the nurses whom she first encounters.

2. Notice if your patients seem worried and when so, in a tactful manner, avoiding all appearance of curiosity, try to ascertain what is the matter, for their anxiety may be about something for which relief can be found.

3. Notice if any of a patient's visitors tire or annoy her and, when so, notify someone in authority.

4. Never expose a patient more than necessary when giving treatments and the like.

5. Always put a screen or draw the bed curtains around a bed in the ward before giving a patient a bedpan, doing surgical dressings, giving baths, treatments, and the like.

6. Before starting to do anything for a patient be sure that you have everything that you will need for the work at hand.

7. Before beginning a treatment, tell a conscious patient something of what you are to do, especially when you are to use some apparatus that may seem mysterious or alarming to the patient.

8. Notice when a light worries a patient or when she is in a draught.

9. Endeavor to remember a patient's likes and dislikes, especially in regard to her food.

10. Never take longer than absolutely necessary to fulfill a patient's request, especially when she has asked for the bedpan or a drink.

11. Never whisper in or near the sick-room, or, when in a ward, near the bed of the patient about whom you are speaking—*not even if she is apparently unconscious.*

12. Do not discuss a patient's condition with her or with anyone else in her hearing and, as far as possible, avoid telling a patient what medication she

is getting, what her temperature is and the rate of her pulse, even when they are normal. Great tact is often necessary in carrying out this last instruction for patients are often extremely irritated when a nurse refuses to give them all desired information regarding their condition and treatment.

13. Never, under any circumstance, tell a patient anything about your other patients for, if you do, she may fear that you will discuss her and her ailments with others.

14. Do not give a patient any unfavorable information regarding the hospital equipment or the capacities of those employed in it, on the contrary, do everything in your power to increase her confidence in the general efficiency of the institution, for such confidence is a most essential element for a peaceful mental state.

15. Never lean or sit on a patient's bed and be careful not to knock against it in passing.

16. Never rock in a sick-room.

17. Keep door and window hinges oiled and never allow doors or windows to bang. Find the source of irritating noises, even if they are out of doors, and stop them if possible.

18. Make and keep your patients as comfortable as possible for bodily discomfort will be very provocative of restlessness and mental disturbance.

Some of the means that can be used to secure comfort and relieve discomfort are as follows:

1. Rub the body, especially the back with alcohol or give a light massage, unless existing conditions prohibit its use.

2. Pull the draw-sheet partially through under the patient so that she may lie on a cool place.

3. Change the position of the pillows when they become disordered or uncomfortable.

4. Place small pillows or pads or hot-water bags filled with tepid water in the hollow of the back when pain has been caused in the latter by lying for a long time in one position.

5. When the patient is very thin, relieve pressure on bony protuberances by laying air rings or pads made of batting or non-absorbent cotton and gauze under them.

6. Flex the patient's knees as described on page 68 to relieve abdominal strain or pain by relaxing the abdominal muscles.

7. Support the bedclothes on a cradle when their weight causes discomfort to any part of the body.

8. When there is a tendency to foot drop, as is often the case with old people and with children suffering with poliomyelitis or cerebro-spinal meningitis, put a support at the feet; a large sandbag furnishes an excellent prop for such purposes.

9. When a weak patient lies on her side or sits up in bed, she must be supported with pillows, it would be impossible to state definitely how the pillows should be placed other than that they should be so arranged that the patient is so adequately supported—that it will be no effort for her to maintain her position.

10. Change the patient's position, if possible, when she is tired and do not forget that no matter how comfortable a helpless patient may be made she is likely to become excruciatingly tired if she is obliged to remain in the same position indefinitely. A frequent change of position is also often necessary to prevent pressure sores and, sometimes, especially with old people, hypostatic pneumonia.

Demonstration 19

Making a Patient Comfortable

Requisites: A back rest, pillows, 4 large and 2 small; cradle; 2 large sandbags; hot-water bag; rubber rings and cotton pads of different sizes.

The pupils should in turn "be patient" for this demonstration and be made comfortable in all conceivable positions and the various appliances required under the circumstances mentioned in the preceding paragraphs—air rings, cradles, etc.— should be used. Special attention should be paid to the manner in which the patient is turned and moved. The methods of doing so for this demonstration are the same as those previously described and, as the pupils have already been shown the essentials of the technique, it should not be necessary for the instructor to demonstrate, in fact, it will be better practice for the pupils to decide for themselves how to proceed. The following sections on pressure sores and chafing should be studied in preparation for this demonstration.

Pressure Sores

A pressure sore is an ulceration and sloughing of a localized area of tissue due to the death of its cells, as the result of pressure.

The reason for such death is that the cells depend for their nutriment, and thus for their life, upon material which osmosis from the blood-vessels into the tissue spaces and pressure upon a part, if long continued or intense, interferes with the circulation in the capillaries supplying it and squeezes the lymph[1] from its contact with the cells.

[1] What is lymph?

The common causes of such pressure are: (1) The too tight adjustment of splints and orthopedic appliances; (2) the bed; (3) crumbs in the bed or wrinkles in the sheets or nightgown, etc. Pressure sores which develop from causes two and three are commonly known as *bed-sores.*

Potent incitements to the formation of pressure sores are: Moisture and breaking of the skin; for moisture softens the tissue and a break in the skin, by removing the covering that nature has provided for the protection of the softer and more easily injured tissues, allows of their being readily affected by adverse external influences, also, it permits the entrance of bacteria and consequent suppuration.[1]

The common courses of moisture are: Diaphoresis[1] and involuntary urination and defecation.

The chief cause of breaks in the skin other than the state produced by pressure are: chafing—see page 92—crumbs in the bed; wrinkles in the sheets, nightgown, bandages, binder, etc.; pulling a pad, sheet, douch pan, etc., from under the patient without first raising her sufficiently to avoid scraping the skin; too hard rubbing when washing or massaging tender parts.

Signs that pressure is affecting the circulation in a part and injuring its tissues are: Increasing redness and soreness followed by, unless the condition is relieved, an edematous state of the surrounding area and deepening discoloration. Such a condition is soon followed by breaking of the skin and ulceration,[1] and in bad cases, sloughing[1] of the exposed parts.

A wound of this kind is usually particularly painful

[1] What is meant by: Suppuration; diaphoresis; ulceration: sloughing?

and it is hard to heal, because it cannot do so until the sloughs are removed, for these are masses of dead tissue which cannot be recuperated, and their removal is often a very tedious process. Also, the open surface and decomposing sloughs afford the best possible soil for suppuration and the consequent production of toxins,[1] which will be absorbed by the blood, and even the least virulent toxins are detrimental to normal body conditions.

As the toxins, pain and discomfort will certainly retard, and perhaps prevent, a patient's recovery and cause her what is usually unnecessary, because preventable, suffering, nurses must feel that the prevention of such sores is one of their most important duties and that every effort and abundance of time are to be devoted to the endeavor. *Except in very, very rare instances, the nurses in charge of a patient are responsible and should feel thoroughly disgraced if she develops a bedsore. Unremitting care has saved many a patient from this infliction when it has seemed perfectly impossible to do so. To do this is one of the greatest achievements in nursing and, the greater the difficulties, the greater should be the nurses' desire and ambition to surmount them and show what "good nursing" can do.*

The localities in which pressure sores will form most rapidly are: Over the bony prominences,[2] such as the end of the spine, the heels, shoulder blades, elbows; and, especially in obese patients and those

[1] What is meant by toxins?

[2] The walls of the blood-vessels are much more easily pressed together, and the circulation of the blood through the vessels thus prevented, when the latter are near the surface and upon a resisting ground, as bone, than when they are embedded in a soft yielding tissue.

with edema, the buttocks; and, in children, the back of the head and of the ears.

Physical conditions conducive to the formation of pressure sores are: Emaciation; lowered vitality, as in old age or long continued illness; conditions which interfere with the circulation, as heart disease, or with the nutrition of the cells as excessive obesity, edema, paralysis, diabetes, severe anemias.

Measures necessary to prevent pressure sores: From what had been said regarding the causes of pressure sores it can be readily appreciated that the principal means of preventing them will be measures which will preclude pressure, friction, and the presence of moisture, and that will improve the circulation of blood and lymph in the parts. Examples of such measures are: (1) Adequate padding of splints and orthopedic appliances; care not to adjust these or bandages any tighter than necessary to attain the purpose for which they are used, but (2) to have anything that will move and cause friction fastened sufficiently securely to prevent it doing so. (3) To keep the bed free from crumbs, and sheets, nightgown, pads, binders, and the like free from wrinkles. (4) To keep the bed free from moisture; as an aid to accomplishing this, if the patient is having involuntary urine or defecations, put a soft pad which can be changed as soon as it becomes wet under her and it is most imperative for the rubber sheet to have a thick enough protector to hinder it preventing the evaporation of sweat. (5) To keep the skin of the affected parts in good condition by (a) washing it, very gently,[1]

[1] If the parts are so soiled that gentle washing will not clean them, apply a little warm oil to soften the soiling matter and then remove this with ether or warm alcohol.

using a soft cloth, with hot water and soap, at least twice a day, (b) applying alcohol and a little powder after the wash and, if necessary, as often as every hour; (c) massaging the surrounding area at least three times a day—when doing this, keep the fingers or hand still on the part you are massaging and move the tissues; do not rub the skin, especially of parts that are discolored for, by doing so, you may cause a break. (6) To, if possible, frequently change the position of a patient whose condition is conducive to the formation of bedsores, it may be necessary to do this as often as every hour. (7) To relieve pressure upon parts that show signs of irritation and congestion by the use of rings[1] or soft pads and, in extreme cases, an air mattress. An air mattress must not be made more taut than absolutely necessary or it will cause as much pressure as an ordinary mattress.

It is, of course, when a patient's position cannot be changed that the danger of the development of bedsores is greatest, and, in such cases, all the other precautions must be the more conscientiously and frequently carried out.

As soon as there is any indication of the formation of a pressure sore the doctor should be notified. If the skin breaks, the sore must be treated as an open

[1] When rubber rings are used for this purpose they should only be inflated enough to keep the congested parts from the bed, otherwise, the rings will make pressure and aggravate instead of relieving, the danger of bedsores. Also, they should be properly covered, for rubber, when in contact with the skin, prevents the evaporation of sweat and is thus conducive to the presence of moisture. Soft flannelet cases *which fit the rings so snugly that they will not wrinkle* are about the best things to use for this purpose.

wound arising from any cause (this will be discussed under wounds) and the usual aseptic precautions taken.

Chafing

By chafing is meant, in this instance, **to make sore by rubbing** and the common sources of friction are: (1) The apposition of two surfaces of the body; (2) the contact of rough or otherwise irritating clothing, bandages, and the like.

The common sites of the worst degrees of chafing are: The buttocks, especially in infancy; between the chest and pendulous breasts; between the thighs and a pendulous abdomen.

Predisposing causes are: Moisture; a tender skin, as in infancy; conditions which interfere with proper nutrition of the skin, as obesity, long-continued illness, dropsy, and poor circulation of the blood from any cause.

The signs of chafing are: redness, and, usually, itching of the skin; also small pimples or similar lesions may appear.

Deplorable consequences may complicate chafing if the condition is not ameliorated for the skin is likely to break and then ulcers may form, and though, unless the ulceration is allowed to progress, there will not be the sloughing of tissue that occurs in pressure sores, the ulcers are painful and often hard to heal.

The preventative measures are keeping the skin clean and dry and excluding all causes of irritation.

By keeping the parts clean is meant not only free from visible soil, but, also, from the excretory products

of the skin; thus, the parts should be washed with warm water and a good soap at least twice a day, and an infant's buttocks and the surrounding parts must be washed after every defecation. The washing and drying should be done by gently patting, not rubbing, the parts. All the soap must be removed with clear, warm water. This especially in the care of infants, is most important for even the best soaps, if not washed off, may irritate a tender skin. The washing should be followed by an application of (a) alcohol, (b) powder and the parts massaged, as for the prevention of pressure sores, without friction—a tender or irritated skin should not be rubbed. Alcohol, or some astringent wash, and powder must be applied after each washing, and more frequently if necessary, and a thin layer of soft absorbent material—as absorbent cotton—put between irritated skin surfaces that come in contact and this is to be changed if it becomes at all damp.

Proper washing of a child's diapers is a most important prophylactic measure against chafing and ulceration of the buttocks. Only good laundry soaps should be used and never strong soda or other alkaline solutions, and the diapers should be rinsed through at least two supplies of clear water. Rough or harsh material or that rendered so by washing should not be used for diapers.

As free circulation of the blood through the superficial blood-vessels of the threatened parts is a most important preventative and curative measure,[1] all possible means are to be taken to avoid even slight pressure.

The treatment of ulcers arising from this cause will

[1] Why?

be the same as that of a wound similar in character. See Chapter 16.

Demonstration 20

Lifting and Elevating an Inflamed Limb

Reason for elevation. The blood-vessels in an inflamed area are abnormally distended with blood and, consequently, there is an excessive exudation of fluid into the tissues of the part. As the result of this engorgement, there is pressure upon the nerve endings in the area and the consequent stimulation of some of these gives rise to pain. A common mode of treatment in some inflammatory conditions, when the affected part is a limb, is to fix it in an elevated position as this favors the venous—return—flow more than the arterial and, therefore, tends to lessen the amount of blood in the part without interfering with the circulation and thus to relieve the pain. As a rule, the limb is also more or less immobilized, in some cases, because absolute rest is essential and, in others, because any movement causes pain and twitching movements, due to reflexes[1] occasioned by the pain, are common in such conditions.

Special points to be considered when moving and arranging an inflamed limb are: (1) Movement causes pain and therefore must be done carefully. (2) The whole limb should be supported while it is being moved and after it is in position. (3) As a rule the elevation should be gradual, and if it is a leg that is elevated the support should be so arranged that it will afford a rest for the thigh also. (4) If the affected

[1] What is meant by reflexes?

part is a leg, the covers should be held on a cradle[1] as their pressure upon the foot will cause pain.

Requisites: Four ordinary-sized pillows and two small ones protected with rubber cases put on under the white ones: a cradle (one with a flat top is to be preferred) or substitute[1]; a bandage; white twine; three safety pins; two splints (one about six inches wide), the length of the patient's leg, and, if of wood, about one half inch thick, at one end there should be an upright piece for a foot rest and a hole about three inches in diameter where the heel will rest; also there should be a small hole in each corner of the splint; the second splint should be about the same thickness as the first and about the length of the patient's arm—both splints should be padded with cotton; three pads of sphagnum moss and non-absorbent cotton or wadding two of these should be about 6 x 9 inches and one about 6 x 16. The latter should have a hole about two inches in diameter in the center, the hole should be enough smaller than that in the splint to form a padding between the interior of the latter and the patient's heel. One end of this pad should cover the foot rest and the hole should be over that in the splint. It is well to pin the pad at the sides to the bandage covering the splint in order to keep it in place while the splint is being drawn into position.

[1] A good substitute for a cradle is a right-angle bar of piping set in a weighted footpiece which stands on the floor; the horizontal bar extends over the bed, it can be adjusted to different heights by turning the screw. This has two advantages over the cradle for many purposes: (1) it does not restrict the patient's movements nor (2) obstruct the view as much as the cradle, common objections that patients have to cradles.

Procedure in elevating an inflamed leg: Arrange your equipment in the order in which you will need the articles and place them within easy reach.

Loosen the upper bed covers at the bottom of the bed on the side of the affected leg. Turn them back neatly so as to expose this leg to above the knee.

Put the splint on the bed with its upper rim against the patient's foot.

Put your hand which is farthest from the patient's foot under her ankle and the lower part of her leg, and raise the latter sufficiently high—but no higher—to slip the splint under it.

Pass a doubled strip of gauze under the splint at each extremity and in the center and tie these around the leg.

Unpin the pad and arrange its ends so that they fit into the curves of the foot and around the heel and see that the pad protects the heel from the walls of the hole. Repin the pad to the splint covering at the sides if necessary. Another pad may be required between the splint and foot and one at the edge of the splint under the knee.

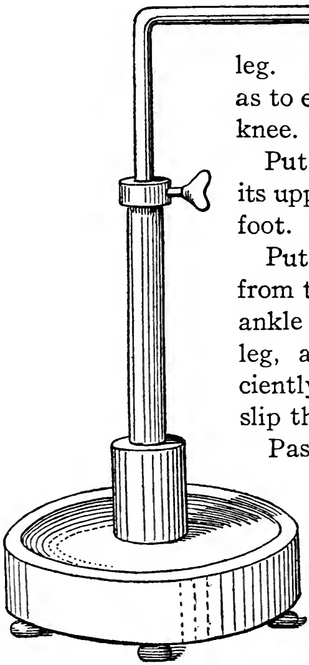

Fig. 16. Substitute for Bed-cradle.

Place the pillows—two to four according to the

degree of elevation required—lengthwise on the bed just below the foot that is to be raised, put one upon the other, but each one about three inches farther back from the edge nearest the foot so as to form an incline that will fit under the thigh.

Slip one arm under the splint from the top to the bottom and raise the leg,[1] draw the pillows under until the nearest edge of the upper one comes under the knee.

If there is any part of the thigh not resting against the pillows, fill the space with small pillows or pads.

Put a piece of twine through each corner hole of the splint and tie the ends to the cradle. This procedure is sometimes omitted, but supporting the splint in this way makes it easier for the patient to change her position without moving her leg. If an ice-cap is used tie it to the cradle in such manner that the weight on the leg will be lessened.

To elevate the arm proceed in the same manner as for the leg, but, as a rule, one or two pillows are all that are required and a cradle is only needed if an ice-cap is used. Unless conditions exist which make immobilization of the fingers necessary, the splint is only put under them as far as the knuckles. If the lower pillow does not extend into the axilla, fill the space with a pad.

Demonstration 21

Undressing a Bed Patient on Admission

Preparation of the bed for a stretcher patient: Turn down the bedclothes, folding them neatly to

[1] To raise an inflamed leg when no splint is used, slip one hand under the ankle and the other under the knee, have your hands facing each other and pass them as far under the leg as possible.

the foot of the bed; cover the bedding with a rubber and this with a bath blanket; place a folded bath blanket across the foot of the bed. This is drawn over the patient as soon as she is laid upon the bed, and is used as a cover while she is being undressed and bathed.

To undress the patient: (1) Unbutton the waist, remove the sleeve nearest you in the same manner as that of a nightgown, if the waist buttons in front pass the loosened side behind the patient (to do this turn the patient on her side or, if this should not be done, pass your arm behind her shoulders, raise her slightly and, stretching across her, with your free hand draw the waist from under her); remove the other sleeve. If the waist buttons in the back remove it in the same manner as a short nightgown that opens in the back (see Demonstration 6). If one arm is injured the sleeve must be removed from it last.

2. Remove the skirts. To do this, unfasten them, flex the patient's knees if possible, draw the skirts down as far as you can, put one hand under the patient's thighs (inside the skirts) and raise her and, with your other hand draw down the skirts; lower the patient's thighs, pass your hand inside her skirts, under her legs, raise these and draw off the skirts. If drawers are worn they can be removed at the same time as the skirts.

3. Remove undervest and chemise in the same manner as a nightgown.

4. For method of removing stockings, see Demonstration 18.

Sometimes, especially after accidents, it is necessary to cut some of the clothes in order to remove them without disturbing the injured part; when this

is necessary, cut in the seams and injure the material as little as possible.

While undressing a patient notice if there are any abnormal conditions present, *e. g.*, a rash, scratches, abrasions, swellings, edema, loss or impairment of motion; if there is evidence of recent loss of flesh, *i. e.*, a loose or wrinkled condition of the skin. Report any abnormalities and any information regarding her condition given you by the patient to the head nurse.

Demonstration 22

Care of Patient's Belongings

Negligence in the care of patient's clothes and valuables is a common source of quite unnecessary, because avoidable, trouble in hospitals. Therefore the pupils should pay very special attention to the details of this demonstration[1] and always put them into practice. As the arrangement for the keeping of the patient's belongings varies in different institutions the details also must be diverse, but all arrangements are based upon certain necessary precautions, viz., against loss or theft of the patient's property and against false claims made by the patients or their friends. Thus, in most institutions a clothes record which is usually either a book or a card register, is kept in the receiving ward or, if the patients are not undressed there, on each floor or ward or,

[1] In order to guard against mistakes after the pupils have been shown their hospital system for the care of the patient's clothes, each pupil should be required to carry out the entire procedure. As this varies so greatly in different hospitals, it seemed better to give the general principles here rather than the minute details of any one method.

sometimes, a supply of cards is kept in the receiving or general wards (wherever patients are undressed), but the register is kept in the main office and a card is taken there as soon as it is filled in. But, whatever the method, everything taken from the patient is listed. The nurse who undresses the patient makes out and signs this record, also the patient, if she is in fit condition, or, if she is not, a friend, if such is with her, or, if she is alone, a second nurse, and, later, when the patient receives her chattels, she again signs the record, acknowledging their receipt; or, if they are delivered to someone other than the patient, the recipient must sign it. It is of course very essential to be sure that the person to whom the things are delivered has a right to receive them. The record is to show all that happens to the patients' belongings from the time that they are taken from them until they leave the hospital and, also, the names of all persons who have had anything to do with them.

Requisites: Enough articles of clothing to demonstrate methods of folding and hanging and search for lice, a clothes record, and whatever other articles that the institution's system necessitates the use of.

Procedure: Even before the patient is undressed, unless she is in poor condition, you should ask her or whoever is with her, if she has any valuables with her that should be taken to the office for safekeeping. If the patient is too ill to be bothered and there are no friends with her, go through her pockets or bag as soon as you have undressed her and remove their contents. Have some responsible person as witness while you do so (patients have made false claims of property lost, hence the need of a witness). N. B. *As soon as you take or receive valuables from a patient*

you are responsible for them until you deliver them to the person detailed by the institution to care for such things, therefore if you cannot dispose of them at once, lock them in a safe place or else keep them in your own possession. If you put them, for example, on a table and they are stolen or lost you will be likely to be required to pay for them. *Never throw away even a scrap of paper that you take from a patient's pocket.* Have the person to whom you deliver this property sign the record.

As regards the clothes, remember that no matter how poor they are they are not to be crushed, if they are old, they are probably the best that the patient has and it is an unpardonable unkindness to do anything to them that will make them worse than they are.

Hang skirts, waists, dresses, trousers, and coats; fold underwear neatly and, unless a separate locker is provided for each person, tie them together and tag them, in such case tag all other articles (hats, coats, shoes, etc.), and inscribe the tag with the name of the ward or floor, the patient's name, and the date. Except when the locker is in the patient's room, write its number in the record book and if for any reason the clothes are changed to another locker at any time *do not forget to change the number in the record.* If the clothes are soiled send them to the laundry; if they are infected with lice, or if the patient has an infectious disease, envelop the clothes in a protector and send them to the sterilizing room and state in the record that you have done so. The means taken to insure the return of the clothes and their subsequent identification varies in different hospitals. In small institutions a duplicate list to send with the

clothes may be all that is required, but in large hospitals further precautions are generally necessary, and a common custom is to attach tapes marked with the number of the ward or room and either the patient's name or number of the bed to which she is assigned.

When you undress a dirty patient, always examine the clothes for lice; they are, when present, likely to be in seams and gathers.

Cleansing Baths

Why necessary: People who remain in bed may not look dirty but, nevertheless, they need baths quite as much as those who get up. The reasons for this are: (1) The skin, in addition to various other functions, serves as an excretory organ and though the excretions (sebaceous matter and perspiration) consist, especially the perspiration, largely of water, they contain organic substances which, if not removed by washing, decompose and give rise to an unpleasant odor and are conducive to skin lesions which are annoying to the patient and favor chafing. (2) Bathing stimulates the circulation of the blood in the capillaries of the skin and thus aids it in its various functions and lessens the tendency to pressure sores. (3) The majority of patients find a bath both refreshing and sedative.

Bath Temperatures

A bath with a temperature between:

55°	and	65° F.	is known as a	cold bath
65°	"	75° "	" " " "	cool bath
75°	"	85° "	" " " "	temperate bath
85°	"	92° "	" " " "	tepid bath
92°	"	99° "	" " " "	warm bath
99°	"	112° "	" " " "	hot bath

How many baths necessary: The desideratum is a daily bath for all patients, but in many of the large hospitals it is impossible to give ward patients this many; private patients, however, and all very sick patients must be bathed this frequently and others at least twice a week. This being the minimum, every nurse should feel that no matter how busy she may be, a biweekly bath is not to be omitted.

The ideal times for patients' baths are (1) about an hour after breakfast and (2) just before they are ready to go to sleep at night. In the wards, however, the baths may have to be given at odd times as the other work permits, but at least one hour should intervene between the eating of a meal and the giving of a bath, the reason for the delay being that the bath, by exciting cutaneous nerves, improves the circulation and increases the amount of blood in the skin vessels and, consequently, removes some of the blood which went to the digestive organs in response to nerve stimulation aroused by the taking of food. This action interferes with digestion because, if they are to function properly, the glands which secrete the digestive juices must have the extra blood during the period of their greatest activity.

Tub Baths

Important points to remember in connection with tub baths are:

1. Junior nurses should ask permission of the head nurse or a senior before allowing a patient to have a tub bath either on admission or during the early stages of convalescence.
2. See that the bathroom is warm.

3. Be sure that the patient has everything that she needs for her bath—bath towel, face towel, wash-cloth, nail brush, soap, clean clothing if necessary.

4. Fill the tub half-full of water about 96° F., usually not hotter. Let the cold water run into the tub at the same time as the hot. Never run the hot water in first, especially, when preparing the bath for a child, for this has been the cause of many accidents.

5. Even when a patient is able to take her own bath, do not allow her to lock the door nor leave her long alone without at least speaking to her to ascertain that she is all right.

6. If for any reason other than therapeutic purposes, the bath water is above 96° F., do not let the patient remain in it longer than ten minutes. For reason see page 222.

7. Even when your patient takes her own bath, you are responsible for her cleanliness, therefore, if you think that supervision of the bath is required, help her undress and, if you find that it is needed, make some excuse, to avoid offending her, for proffering your help; *e. g.*, that you do not wish her to become too tired.

8. As soon as the patient leaves the bathroom, wash the tub and tidy the room.

Demonstration 23

Cleansing Bath in Bed

Equipment: Something to protect the bed—for a bath given a patient on admission, the rubber and bath blanket which are put over the bedding before the patient is put on the bed answers the purpose, the patient usually, unless she is in poor condition,

being bathed as soon as she is undressed; at other times, a bath blanket, without the rubber, is used except when the patient is too ill to be turned or when the bath is given merely as a means of refreshing the patient, in which case a bath towel is often substituted; a bath blanket to cover the patient, a toilet basket—see page 36—at least two towels—a face and a bath towel—a washcloth, a foot tub, and a basin each about one third full of water approximately 110° F., two chairs, and a table.

Procedure: 1. See that the window near the patient's bed is closed and that the room or ward is warm.

2. Collect your equipment; place the chairs at the foot of the bed and arrange the other articles where you can reach them as you require them.

3. Replace the upper covers with a bath blanket as described in Demonstration 12, but draw them down over the backs of the chairs, instead of leaving them folded at the foot of the bed, so that the sheet may air while you are giving the bath; or, if the bath is given before the bed has been made, loosen the clothes at the foot and remove each article separately, taking it near its center, and hang it over a chair.

4. Draw the patient to the side of the bed and, if possible, turn her on her side.

5. Go to the other side of the bed, taking the unused blanket with you, turn back the one with which you have covered the patient enough to put it out of your way; gather up one side of the other blanket, cover the bedding with it, putting the gathers close to the patient's back; go to the other side of the bed; turn the patient over and pull out the gathers so that the blanket will cover the sheets on the side at which you are standing.

6. Remove the nightgown.

7. Proceed with the bath, washing in the following order: Face, ears, neck, arms, hands, chest, abdomen, back, thighs, legs, feet, pubic region. While working remember the following points:

Make (a) Firm pressure.

(b) Unless the patient is very dirty there need be no exposure during the bath. If it is necessary for you to observe your work, expose only the part that you are washing at the time.

(c) After washing a part, dry it before going farther.

(d) Wash and dry the ears, between the fingers and toes, the axilla, and pubic region particularly well.

(e) Use the water in the basin for the face, neck, arms, and hands.

(f) Before washing a hand place the towel and (on this) basin under it, then soak the washcloth with water and squeeze the water through the fingers; repeat this procedure after washing the hand with soap and then place the hand on the towel, remove the basin, and dry the hand. Treat the other hand in like manner.

(g) If the knees can be flexed and there is no reason why the feet cannot remain in water for a few minutes, put them into the tub before beginning to wash the thighs and legs. To do this: Flex the patient's knees, put the tub on the side of the bed near the feet, under the blanket; place your arm that is nearest the foot of the bed across the tub—see Fig. 27—this prevents the blanket getting into the water; put your free arm under the patient's legs and your hand under her heels; raise the legs and feet; draw the tub under them and lower them into the water.

(This, like the rest of the bath, can be done under the blanket.)

To remove the feet: Fold the bath towel and place it on the bed at the far side of the tub; take hold of the feet and tub as before; raise the feet, hold them over the tub for a few seconds until the water stops dripping from them, place them on the towel; remove the blanket from above the tub; take the tub from the bed; dry the legs and feet.

(h) Turn the patient on her side before washing her back, if she is weak, this is best done by grasping the side of the blanket on a line with her shoulders and thighs and raising it upward.

8. Cut and clean the finger and toe nails if necessary. Have a towel under them while you are doing so.

9. Remove the lower blanket. To do this, turn the patient on her side, move the blanket as far under her as possible, turn her over on to the bed, draw the blanket from under her.

10. Remove the upper blanket. To do so, take hold of the upper edges of the bed covers, draw them up to the foot of the bed, then include the lower end of the blanket in your grasp and draw clothes and blanket upward, take out the blanket.

11. Put on the nightgown.

12. Remove all your equipment and put chairs, etc., in place.

When it is desired to give a bath without disturbing the patient as much as the preceding method necessitates as, for example, when the patient is very ill or when the bath is given in the evening, just before the patient is ready for sleep omit the blanket under the patient and, instead of it, protect the bed by

putting a bath towel under each part before washing it. This method of protecting the bed is also sometimes used for a patient who is bathed daily when the bath is given before the bed is made.

Admission bath: Many patients admitted to hospitals are exceedingly dirty and a very liberal use of soap and water is required; for this reason, as already stated, protect the bed with a rubber, put under the blanket. When the patient is dirty, it is well, after washing the face, to put some ammonia in the water.

To remove machine grease from the skin, wash the soiled parts with hot alcohol. Heat the alcohol by putting the bottle containing it in a sterilizer or basin of water and this over the flame which it must completely cover so that the flame cannot reach the alcohol, which is inflammable, put a piece of folded gauze or a towel between the bottle and the metal container or the former may break. (Why?) Ether and benzine will also remove grease, but, as a rule, patients do not like their odors. The alcohol should be brought to the bed with the rest of the equipment and kept in the hot water until required.

If the feet cannot be made clean by one washing, after the bath is completed, put a rubber covered with a towel under them, envelop each foot in a compress of gauze or a towel saturated with hot green soap solution, wrap the towel and rubber around them and let them remain thus for about an hour, then wash them again. To do this, raise the covers at the foot of the bed to about the knees, the rubber under them will serve to protect the bed. The use of sapolio and a nail brush may be necessary.

Lice. If the patient is very dirty look for body

lice. There are three forms of lice which infest the body, the head louse or *pediculosis captis* which will be described later; the body louse known as *pediculosis corporis* or *pediculosis vestimenti*, and the *pediculosis pubis* or *crab louse*.

The body louse lives in the seams and gathers of clothing but feeds on the body, the signs of its presence are scratch-marks made by the patient in an endeavor to overcome the itching, and petechiæ[1] produced by the bite of the insect. When such are present the clothing should be most carefully investigated and, if necessary, fumigated, and the patient's body should be washed with lysol or bichlorid 1 : 2000 before the regular cleaning bath, and the latter should be exceedingly thorough. Everything used for the baths should be disinfected.

The crab louse is a very small, gray, translucent insect that infests parts of the body, other than the head, that are covered with hair, as the pubic region, axillæ, eyebrows. The treatment is the same as for the body louse and, in addition, after the cleansing bath, a parasiticide such as sulphur ointment or ointment of ammoniated mercury should be rubbed into these parts. Only a small amount of the latter should be applied in any one place at a time.

Demonstration 24

Bathing Infants and Small Children

Proper temperature of room and water. Have the temperature of the room in which a baby is to be bathed between 70° and 75° F. The proper tem-

[1] What is meant by petechiæ? Why should the bite cause such a mark?

perature for the water may be determined by the following table:

For an infant under three months.......	95° to 100° F.
For an infant three months and upward..	90° to 96° F.
For an infant one year.................	85° to 90° F.
For an infant two years................	75° to 80° F.

Requisites: Rubber apron, washcloth, two soft, warmed towels, two small, warmed bath blankets, a foot-tub containing water, soap (only pure, unscented, oil soaps should be used for bathing children, or, better, a small basin of soap suds), powder, infant's clothing; a large doll can be used for the subject.

An infant under three weeks of age is either bathed in the lap or by spraying; as a rule, a baby is not put into a tub until the cord is off and the umbilicus healed.

Procedure when the bath is given with the baby in the lap:

Put on the rubber apron.

Arrange the equipment where you can reach everything as you require it from your seat.

Take the baby in your lap and envelop it in a blanket, have the opening of the latter on the side nearest you.

Undress the baby.

Bathe first the face, head, and neck and then, in turn, the arms, chest, legs, back, buttocks, around the rectum, and external genitals.

Wash each part with (1) dilute soap suds; (2) clear water and then dry it thoroughly, but gently, before proceeding to another part. Do not expose the baby during the bath. Pay particular attention

to the eyelids, ears, buttocks, and all surfaces where two folds of the skin come together. In little girls, separate and clean between the labia; in boy infants, once or twice a week, draw back the foreskin to see that there is no dried urine or other soil adhering to the penis. But a most important point to remember is, that though the external genitalia are to be kept clean, they are to be handled as little and as gently as possible, for stimulation of nerve endings caused by handling these parts during bathing may originate the desire that leads to masturbation.

Put your left arm under the blanket and baby in a manner to adequately support the latter, draw the other blanket over your lap and put the baby down on this, discarding the other blanket. Bring the end of the fresh blanket around the baby and pass your hand back and forth over it so as to remove any remaining moisture from the baby's skin.

Powder the baby if necessary and dress it. Powder helps to dry the skin and to prevent chafing where two surfaces of the body come together; its use, however, is seldom necessary except in hot weather. Never use much in any one part and use it only where it is necessary.

Procedure in giving a baby a tub bath:

Put on the rubber apron and arrange your equipment.

Cover your lap with a blanket.

Hold the baby on your lap while you undress it.

When putting the baby in the tub, have your left wrist and hand under its head and shoulders with your thumb and little finger extending into the axillæ. Hold the legs with your right hand.

Keep your left hand in the same position during the bath and wash with your right hand.

Do not keep the baby in the tub more than two or three minutes.

When the bath is concluded, cover the blanket on your lap with a towel.

Take hold of the legs in the same manner as when putting the baby into the tub and raise it from the water, hold it for a second above the tub, put it in your lap, cover it with the towel and blanket. Rub gently over these. Take the other towel and finish the drying.

Endeavor should be made to have children like their baths, therefore, if a child does not, as soon as it is old enough to notice and desire a toy, put one or two floating ones in the bath water.

After a child is two or three years old conclude the bath by spraying her with water about 70° F., have the water in which she is standing about 80° F. The use of cold water in this way trains the child's system to react normally to cold and this tends to lessen any propensity to "taking cold." The nature of the body's reactions to temperatures will be found in Chapter 6.

Spray-baths. In many hospitals bath tubs are no longer used for infants and small children, for it is thought that a tub which is used for a number of children may be a means of transmitting infection, and marble or tiled slabs sloping to a sink, with sprays to convey the water from the tank in which it is contained, have been substituted. As the slab is covered with a towel that is sterilized after use, an infant does not come in contact with a surface that has been touched by another until it has been disinfected.

Figure 17 shows the arrangement used in the

Presbyterian Hospital in the city of New York for this purpose. It consists of an eight-gallon copper tank, which is connected with the hot- and cold-water pipes. These terminate within the tank in four small points, those of the cold-water pipe pointing upward and those of the hot-water pipe, downward.

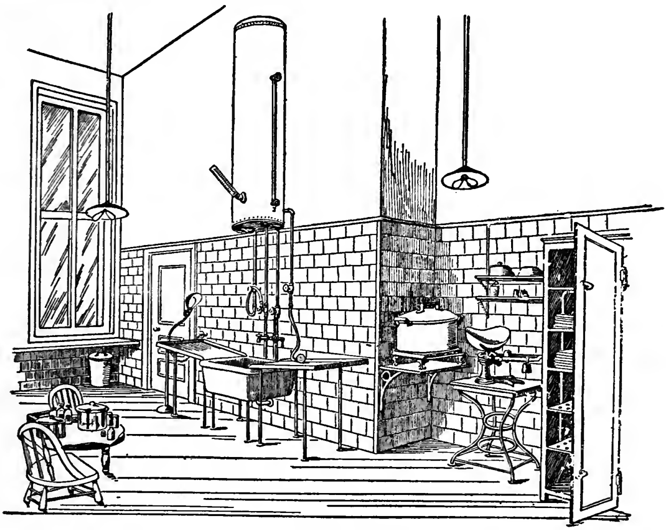

Fig. 17.

This arrangement causes the current of the two streams to go against their gravity tendency, and thus a thorough intermingling of the two streams is effected and the water in the tank is made of uniform temperature throughout. The flow of water into the tank is caused and discontinued by turning valves which are on the pipes a little above the sink. A water gauge on the side of the tank shows the depth of the water within the latter and a thermometer projecting from the front shows its temperature.

8

Each morning, at bath time, the tank is filled with water the required temperature (103° F.). This, it has been found, insures a spray with a temperature of 100° F., and this temperature is maintained within one or two degrees for from three to four hours.

The baby, after being undressed, is laid on a clean bath towel on the slab, sponged with soap suds and then sprayed with the water from the tank. It is then rolled in a warmed towel and blanket, dried and dressed.

After use, the washcloths and towels are washed and then (1) boiled in a sterilizer and (2) dried in a drier provided for these purposes. When dry they are folded and put away.

Demonstration 25

Washing the Hair in Bed

It is better to wash the hair of a woman patient after the bath is completed if it is washed in bed.

Requisites: Two small rubbers, one rubber about forty inches wide and long enough to cover the pillows and extend into the foot-tub when the latter is on a chair at the side of the bed, three face towels, one bath towel, a crushed sheet or newspaper to protect the table, one large safety pin, a quart pitcher of hot soap solution (about 110° F.), a large pitcher of water of the same temperature, a foot-tub, hair-lotion or tincture of delphine or other parasiticide, a large medicine dropper, and a small glass for the hair lotion.

Procedure: Arrange the equipment: Put a protector on the table under the pitchers, place the foot-

tub on a chair or stool near the head of the bed at the side at which you will stand while washing the hair, hang one face towel on a bar at the head of the bed where you can reach it easily.

Draw the patient to the side of the bed and turn her on her side with her back toward you.

Loosen her nightgown at the neck and turn it down.

Double a towel over one edge of a rubber, put these around the neck and pin the towel in such fashion that it will hold the rubber in place.

Move the top pillow from under, but just in front of, the patient's head.

Cover a small rubber with the bath towel and this with the large rubber arranging the latter so that it will extend about twelve inches above, below, and in front of the patient's head.

Put these under the patient's head with the small rubber undermost and covering the pillows, roll up both sides of the large rubber so that it forms a trough with one roll under the patient's neck, have one end covering the near portion of the pillow which was moved, and which serves as a wall for the trough, and the other hanging free over the side of the bed.

Put one corner of a face towel between the patient's face and the roll of rubber and leave the rest of it free to wipe her face with, if necessary, during the shampoo.

Undo the hair and spread it out in the trough.

Draw the chair with the tub into position and put the free end of the trough rubber into this.

Pour the soap solution slowly over the head, turning the latter as required, rub the soap into the scalp and through the hair as you proceed and, occasionally, discontinue pouring while you rub the scalp. When

the soap solution is finished, pour some of the water from the large pitcher into the small one—as the latter is more easily handled—and pour this over the head, rubbing the latter with one hand as you do so.

When the soap has all been removed, squeeze the water from the hair, wipe the patient's face, neck, and ears with the towel that you placed under her face, moving back the rubber at this point when you take away the towel; gather the hair into the towel, remove the trough rubber, letting it down into the foot-tub.

The patient's head is then on the bath towel. Dry the hair with this and the face towel.

When the hair is as dry as you can get it, saturate the scalp with hair lotion or, if there is any suspicion of the presence of lice, with delphine. This is most easily done by filling the medicine dropper with lotion and running the point of the dropper through the hair along the scalp forcing the wash from it as you go. If hair lotion[1] is used, rub it into the scalp; the use of delphine will be described later.

Unpin the towel that is around the patient's neck,

[1] A good hair lotion consists of ℞ Sodium bicarbonate 150 gm.
Ext. witch hazel }
Alcohol 95% } a.a. 835 c.c.
Water }

This quantity is, of course, for the stock solution; only about 2–3 drams are used at a time, being poured when needed into a small glass.

A wash such as this or, if there is dandruff, Resorcin 10 gm.
Alcohol 95% 40 c.c.
Water 50 c.c.

applied, as described, about once a week lessens the frequency of the need for a more fatiguing shampoo.

remove this and the rubber and use the former to replace the bath towel unless it is wet, in such case, use the towel that you hung at the top of the bed.

Fasten the nightgown, place your patient in a comfortable position, spread out her hair to dry. Fan it if you have time.

Put everything around the bed in order and remove your equipment.

Demonstration 26

Washing a Woman's Hair when not in Bed

Requisites: A large rubber, two bath towels, two small towels, a safety pin, a pitcher of soap solution, a large pitcher of hot water if there is not a spray that can be attached to the faucet for the purpose, a bottle of hair lotion, a medicine dropper, and a small glass.

Procedure: Put a folded face towel around the patient's neck, cover one edge of the rubber with a bath towel, and pin this around the patient's neck outside of the other towel. Fold a small towel and put it on the front edge of the toilet basin. The patient can sit either with her back to the basin and rest her neck on this towel or facing the basin and rest her forehead on the towel. Give the shampoo in the same manner as when giving it in bed. When the patient is not in bed it does not, as a rule, make any difference if the shampoo is given before or after the bath.

Care of the hair if pediculi are present. If a patient's head looks dirty examine it for pediculi[1]

[1] The louse which infests the head (the *pediculus capitis*) is a gray insect from 1–2 mm. long.

before giving the bath, pretend that you are combing the hair while you are doing this that the patient may not suspect your object and be offended.

The two common signs of pediculi are: (1) Itching of the head caused by the lice crawling on the scalp and puncturing it for blood, upon which they feed; (2) the presence of nits, which are the eggs of the lice. These look like dandruff, but they cling tenaciously to the sides of the hair, and dandruff is easily brushed off. If the lice have been present for any length of time there are likely to be eczematous lesions extending to the neck and behind the ears and, sometimes, some of the neck lymph nodes are enlarged.

If pediculi are present, before giving the bath, cover the pillow with a rubber and this with a towel,[1] wet the scalp and the hair next to it thoroughly, as already described, with delphine or other parasiticide,[2] turn the towel around the head and either tie or pin it on the forehead. Leave it thus for about two hours (you can give the bath in the meantime) and then comb the hair with a fine-tooth comb, and afterward wash it as previously directed.

As soon as the hair is dry use some more parasiticide; if there are any nits on the hair, wash it, not

[1] If the patient is to have a tub bath, saturate her head with the parasiticide using a medicine dropper, as previously directed, tie a towel around her head, and let her take her bath before washing her head. Otherwise, the treatment is the same as described above.

[2] Other common parasiticides used for this purpose are carbolic acid 1: 40, lysol 2%, bichloride of mercury 1:2000, and kerosene (the odor and the danger of setting fire to the hair if the patient goes near a flame render kerosene objectionable).

the scalp, with hot vinegar.[1] To do this, spread the hair out on the rubber and rub it with a gauze compress saturated with hot vinegar, also draw the hair —taking small strands at a time—between a fold of the saturated compress. If the patient is not in bed, do this with her head bent over the basin as when washing the hair. After doing so flush the basin thoroughly with hot water.

A daily application of parasiticide and hot vinegar should be made until there is absolutely no sign of either pediculi or nits. If the head is very badly infested, especially if the patient is in bed, it is well to keep a towel or square of muslin bound around the head turban fashion.

Everything that comes in contact with the hair when in this condition should be put into a parasiticide, lysol or carbolic being good ones for the purpose, and after treating the hair, you should wash your hands with either lysol, carbolic or bichloride, scrubbing under the nails.

Demonstration 27

To Comb and Brush a Woman Patient's Hair

Only a dying patient should be considered too ill to have her hair cared for in the usual manner. If the hair is done daily and properly its arranging will not entail any discomfort for the patient, If, however, it has been neglected, it is likely to be very tangled and, if the patient is very ill, the tangles may

[1] The outer surface of the nits is of a tough gelatinous nature which parasiticides cannot penetrate and, therefore they will not destroy the vital portion of the nits unless the coat is dissolved; it is for this purpose that the hot vinegar is used.

have to be removed by degrees. Occasionally, a very ill patient is admitted to the hospital with her hair in such a condition that it may have to be cut because the disentangling and cleaning would need to be so extensive that it might exhaust her. This, however, must be avoided if possible and must not be done without the consent of the patient's friends and that of the hospital authorities, *not even if the patient desires it.*

If the hair is very tangled it will probably, to avoid tiring the patient, have to be put in order by degrees, the snarls being removed from a small portion at a time and this braided to prevent it becoming tangled. By doing this at intervals, working for about ten or fifteen minutes at a time, the whole head can usually be put in good order during the day with but little annoyance to the patient. Wetting the portion of the hair that you are disentangling with alcohol or hair lotion or rubbing a little vaseline or oil into it will help somewhat in freeing the tangles.

When a patient is very ill or obliged to keep quiet, the best way to do her hair, as a rule, is to part it right across the center of the head, from the forehead to the nape of the neck, and braid it in two plaits, making the braid on each side quite near the ear so that the patient will not lie on it. This fashion is usually the most comfortable for the patient and it allows of the subsequent arranging of the hair being done without disturbing her. The hair should be attended to twice daily. This and massaging the scalp, using a little vaseline if it is dry, and keeping it clean with hair lotion (see footnote, page 116), will do much to prevent the hair falling. Massage keeps the scalp loose and improves the circulation of blood through

it, two essential things for the nutrition of the hair. A nurse on general duty might not have time to give massage frequently, but one doing special duty should consider it her obligation to do this, if necessary, unless her patient's condition prohibited it.

Requisites: Towel, comb, brush, and, if necessary, either hair lotion, medicine dropper and glass, or vaseline.

Procedure: Place a towel, crosswise, under the patient's head so that it will cover this portion of the pillow and the patient's shoulder nearest you. Part the hair as described in the preceding paragraph and be sure to make the part clear, comb and then brush the strand of hair on the side at which you are standing. If it is tangled begin to comb at the free end and hold the hair between the tangle and the head while you are loosening the snarl. After brushing this strand braid it close behind the ear and be sure that the hair between the part and beginning of the braid is loose enough not to feel uncomfortable but not more so. Remove the towel, go to the other side of the bed and arrange the strand of hair on that side in like manner.

Care of the Mouth

In the case of convalescent patients and those who are not seriously ill the care of the mouth is the same as in health; viz., the teeth are well brushed morning and evening and, when possible, after the midday meal. When people are very ill, however, especially if their temperature is high there is likely to he an insufficiency of the mouth secretions which, in health, tend to keep the mouth moist and clean. This may

be the result of inactivity of the secretory glands of the mouth or of the rapid evaporation of the moisture on account of the high temperature. Whatever its cause, if this condition persists for any length of time, the membrane will become very much dried and cracked and only the greatest care will prevent the collection of sordes.

Sordes consists of the residue of food (this includes liquids except water), dried epithelium, mucus, and bacteria. If sordes is allowed to accumulate, many serious conditions, both local and systemic, may result. For one reason, the sordes becomes so adherent to the mucous membrane that it is almost impossible to free it without causing the parts to bleed and, if this happens frequently ulceration and inflammation will surely follow. Also, the presence of food residue and sordes in the mouth provides favorable conditions[1] for the propagation of bacteria, which are always there, thus they grow and multiply inordinately. The results of this depend upon the strains of bacteria present; for examples, if there are pneumococci, pneumonia may complicate the original disease; if there are pyogenic[2] varieties, septic conditions of the mouth and infection of the cavities communicating with it and adjacent parts may result; thus inflammation of the middle ear[3] (otitis media) is a common sequelæ[4] of diseases such as typhoid when the mouth is neglected.

Usual régime in hospitals. Twice a day, patients who can brush their own teeth are given their dental

[1] What constitute favorable conditions for the propagation of bacteria?

[2] What is meant by pyogenic?

[3] How will infection reach the inner ear from the mouth?

[4] What is meant by sequelæ?

appliances. Some hospitals provide toothbrushes for patients who are without, others supply applicators, which consist of large-sized wooden toothpicks with a small pledget of absorbent cotton wound around one end; others, small squares of gauze which the patients wrap about one of their fingers. If the patients are not supplied with dentifrice, they are given either a small glass of mouth-wash or better of water and the nurse squeezes a small (about one half inch) amount of tooth paste on to a clean square of gauze or an applicator, but *never on the patient's toothbrush* if the tube is for general use. Patients in bed must each be also given a towel, a basin, and, if gauze or an applicator is used, a piece of paper or other receptacle on which to lay these after use.

When a patient is too ill to do her own teeth, the nurse must do them for her. How often they need to be done will depend upon the existing conditions. Certainly, a sick patient's mouth will require a thorough cleansing three times a day and, probably more frequently if she has a high temperature. In such case it will also be necessary to wash the tongue and around the teeth after each feeding. A thorough cleaning should never be done after a meal for, if the patient is inclined to be nauseated, disturbing her then, especially if the back of the throat is touched, may cause vomiting. To avoid this it is also better to allow ten minutes to elapse between the feeding and the washing and to give the patient a drink of water before beginning, for this will help to wash the mouth, in fact, when the mouth is not very dry, it is sometimes all that is necessary. The removal of food residue after each feeding is important for it lessens the need for frequent thorough cleansings.

After the mouth of a fever patient is washed a lubricant is applied to the lips and any other part that is particularly dry. If a thorough cleansing is done just before a feeding, the lubricant is omitted until after the washing following the meal.

N. B. The mouth of a fever patient needs to be washed after feedings at night, as well as in the day time, but, if this is done regularly and the patient is given water frequently, one thorough cleansing during the night may be sufficient.

Care of a baby's mouth. At one time it was the custom to wash even a healthy baby's mouth after each feeding, but it is now very generally considered that if everything put into an infant's mouth is clean, if the child is in good health, it is not, as a rule, necessary to wash its mouth until the teeth appear. An infant's mouth, however, should be inspected daily and washed if necessary. If the child has a high temperature the same conditions are likely to arise as in later life and the same prophylactic measures must be taken, but with the greatest care, for the membrane of an infant's mouth is exceedingly delicate and easily injured by rubbing or the use of a strong mouth wash, thus vigorous cleansing may lead to exceedingly serious conditions. Wetting the nipple of the breast or bottle with sterile water or weak (about ½%) boric acid solution just before the child is fed helps to keep its mouth in good condition.

Mouth washes in common use are: Listerine diluted ½–¼ its strength with water; Dobell's solution likewise diluted; antiseptic solution (liquor antisepticus U. S. P.) diluted as above; equal parts of boric acid 2% and liquid albolene flavored with

lemon juice; permanganate of potash $\frac{1}{2}$–1%.[1] Peroxide of hydrogen diluted with from two to three parts of water is used when the mouth is very dirty. Its use must be followed by that of one of the other washes.

When there is salivation[2] or a relaxed condition of the throat membrane, astringent[3] mouth washes are often prescribed. Examples of these are: Potassium chlorate, 1 : 16; tannin and glycerine, 1 : 14; tincture of myrrh and glycerine, 1 : 4; silver nitrate, 0.1 to 0.5%.

The lubricants in common use are: Cold cream, boric acid ointment, albolene flavored with lemon juice, rose water, or some flavoring extract. When the mouth is not very dry, glycerine and albolene, 1 : 2, flavored with lemon juice or rose water, is often used, but, even when thus diluted, glycerine is somewhat astringent[3] and, therefore, must be used with caution when the mouth is very dry.

Demonstration 28

Thorough Cleansing of a Fever Patient's Mouth

Requisites: Towel, tooth paste, kidney-basin, mouth-wash tray.[4] The tray holds a small bottle of mouth wash; a small glass; two small covered jars, one containing small squares of gauze and wooden

[1] This is an efficient wash and comparatively inexpensive, but it stains fabrics and though the stains can be removed with oxalic acid the process is likely to harm the material.

[2] What is meant by salivation?

[3] What is meant by astringent?

[4] In many hospitals a tray thus furnished is kept on the bedside table by each fever patient. The bottle and jars are washed and refilled daily, the glass is washed after use.

applicators[1] with absorbent cotton wound around one end,[2] and the other a lubricant; a flat enamel or glass dish to receive used applicators.

Procedure: Wash your hands. Put a towel under the patient's chin. Pour just as much mouth wash as will be required into the glass.[3] Moisten the cotton of an applicator in the wash, squeeze about one half inch of tooth paste onto this; rub the teeth with it, back and forth and from the gum downward on the upper jaw and upward on the lower jaw, in front and behind; if there are spaces between the teeth, pass the tip of the applicator through them.

Take a clean applicator, wet it, and wash the paste from the teeth. Then, using as many (but no more) applicators as necessary, wash the tongue, the gums, the inside of the lips and cheeks. Be sure and pass the applicator across the upper and lower parts of the gums at their junction with the lips. While washing the tongue, have the patient extend it as far as possible and hold it between your first finger and thumb; have these covered with a small piece of gauze. Do not dip a used applicator into the solution; if you

[1] Thin strips of whalebone, being pliable, make much better applicators for this purpose than wood, but they are too expensive for general hospital use. When they are used, they are not, like the wooden ones, thrown away after use, but the cotton is removed with forceps and fresh cotton substituted. Wash your hands before putting on the clean cotton.

[2] The pledget of cotton should be of a size to make the tip of the applicator about the thickness of the little finger; if smaller than this it will not hold enough solution, if larger, it will not pass easily between the gums and the lips.

[3] If the mouth is very dirty, wash it with peroxid of hydrogen and remove this with some of the other wash before doing the teeth and then proceed as directed above.

wish to rewet one, pour some wash over it, but do not waste the wash, all mouth washes are expensive.

If the patient is strong enough to rinse her mouth and gargle her throat, raise her head and let her take a mouthful of wash, lower her head, place a kidney basin under her chin, and, if she does not do so herself, turn her head in this direction when she is ready to eject the solution.

Dry the lips with the towel.

With a clean applicator, apply some lubricant to the lips and any other part of the mouth that may require it, *i. e.*, that is very dry. Do not use much lubricant in any one place in the interior of the mouth, for, if the patient is sufficiently conscious, she may find it disagreeable. If the cleansing is done just before a feeding, omit the lubricant until the wash after the feeding.

Demonstration 29

Washing the Mouth after Feeding

Requisites: The same as for Demonstration 27 and, in addition, a glass of drinking water.

Procedure: Wash your hands, give the patient a drink of water. Place the towel under her chin. Wet the applicator in the solution and run it over the tongue, palate, and teeth—before and behind. Do this as lightly as it can be done and yet remove the food residue and disturb the patient as little as possible. Rewet the applicator by pouring solution over it or use fresh ones as needed. Wipe the lips. Take a clean applicator and apply lubricant as in the previous demonstration.

Demonstration 30

Washing a Baby's Mouth

Requisites: The same as for Demonstration 27, but substitute small pledgets of sterile absorbent cotton for the applicators and gauze and in addition to the mouth wash (which is usually sterile boric acid 1 or 2%) have a small bottle of sterile water.

Procedure: Scrub your hands thoroughly. If possible, take the child on your lap; in any case fix it with its head bent slightly backward so that you will be able to see into its mouth. Pour some solution into the glass. Wind a thin piece of cotton around your first finger and dip it in the wash. Open the child's mouth by depressing its chin and wash the interior very gently. Take a clean piece of cotton and wet it with sterile water and let the child suck it. The sucking movements, by pressing the mouth membrane against the cotton, will do much toward cleaning it. Inspect the mouth; if it is not clean repeat procedures. Wipe the lips. Apply a lubricant if necessary.

To Give and Remove the Bed-Pan

As these proceedings cannot be very efficiently demonstrated in the class-room, it will be necessary for each pupil to be shown how to carry them out the first time that she has to do them for a patient, but in order that it may not be necessary to give so much instruction then that the patient will observe it, the pupils should be required to study this section and be given all essential information beforehand.

If the pan is cold, warm it. This is usually done

by letting warm water run over it. Be sure that it is dry. Take it, a cover (this is usually either double-faced rubber or heavy washable material), and toilet paper to the patient.

If possible, flex the patient's knees and place her feet firmly on the bed.

Place the pan on the bed, near the patient.

Put your hand which is nearest the head of the bed under the buttocks (stand, if practicable, at the side of the bed which will allow of this being your left hand); raise her and slip the pan into position. Make sure that it is well placed.

If the patient expects to have a defecation get two gauze compresses, a basin of hot water, and a clean bed-pan.

When the patient is ready to have the pan removed, if her knees are not flexed, flex them; arrange the bed covers so that they will be out of your way, but do not expose the patient. If the patient is not able to use the paper do so for her. Put one hand under the buttocks and raise the patient as when giving her the pan. It is most important to do this for, if you neglect it, even when the patient can move easily without much help, the pan may be jerked and some of its contents spilled. Cover the pan at once.

If the patient had a defecation either put a clean bed-pan under her or else place a gauze compress under the rectum. The former is the better procedure, as all the parts surrounding the anus can then be well douched by squeezing hot water from a thoroughly saturated compress over them before they are washed. If the pan is not used, moisten a compress sufficiently to wash the parts, but not

enough to wet the bed. Protect the latter with the dry compress. Use this to dry the patient.

Wash these compresses and keep them for the same purpose and patient.

If the defecation is very odorous, it is better to remove the pan before washing the patient. When intestinal putrefaction is excessive and in some intestinal diseases, the odor of stools is often very foul, and when this is the case a little formaldehyde should be put in the pan before giving it to the patient as this will deodorize the feces to some extent.

Never empty a pan without noting its contents and if they have the slightest unusual appearance make careful examination and notify the head nurse. This will be further discussed later.

Demonstration 31

Preparation of a Patient for the Night

Requisites: Basin with warm water, soap, hand towel, washcloth, kidney-basin, toothbrush, tooth paste, glass of warm water, comb and brush, alcohol 50%, talcum powder, small whisk, chair.

Procedure[1]: Place the chair at the foot of the bed.

Draw the patient to the side of the bed.

Loosen the nightgown at the neck.

Place the towel under the chin; wash and dry the face, neck, in and around the ears.

Place the towel so that one end will be under the basin when it is placed where one of the patient's

[1] Before carrying out these proceedings in the ward, give the patient a urinal or bed-pan.

As the details of these proceedings have been described in previous demonstrations only their order will be given here.

hands can rest in it. Arrange the basin in such position and wash her hand, squeezing water from the cloth through the fingers. Dry this hand and then treat the other one in like manner.

Place the towel under the chin and clean the teeth.

Turn down the spread and upper blanket over the foot of the bed and chair.

Turn the sides of the remaining blanket and upper sheet over the patient as in Demonstration 8.

Wash and then rub with (a) alcohol, and (b) powder the axillæ, back, and hips, and any other parts necessary for the prevention of pressure sores or chafing.

Remove the pillows, shake, and then replace them.

Shake crumbs from the nightgown and then sweep them from the bed.

Treat the under sheets and rubber as described on page 38.

Arrange the nightgown.

Draw the patient into place.

Arrange the upper covers.

Be sure that the patient is comfortable.

Remove all appliances and tidy the surroundings.

The Restraint of Patients[1]

Important points to be remembered in connection with restraint are:

1. Restraint will, as a rule, aggravate a patient and increase mental excitement and any tendency to violence. As such conditions may be very harmful to the patient in many ways and are likely to prove fatal if states provocative of cardiac weakness exist,

[1] The pupils should study the section on Delirium in preparation for this lesson.

a patient is never to be restrained unless absolutely necessary and, except in extreme emergency, not without the doctor's permission.

2. No more restraint than necessary is to be used and it is to be made as little obvious as possible; for example, when a patient is running a high temperature she often, even though not actively delirious, imagines that she has to go home, or to work, etc., and, unless she is constantly watched, she may get out of bed; therefore, in such case, if the nurse cannot remain constantly with her, which is the thing to be desired, it may be necessary to apply very slight restraint such as a sheet fixed across the thighs so that her movements will be retarded enough to give the nurse time to reach her before she gets up. A patient would hardly notice restraint of this kind, but if her hands or feet were tied, she might be terrified or made angry and, in consequence, her mental condition made worse. For another example, when it is necessary to restrain the hands do so only as much as the exigencies of the case demand; thus, if the restraint is to keep the patient from removing a dressing, it is better, as a rule, to apply it in such fashion that she can move her arms as freely as possible without reaching the dressing.

3. When a patient is insane or delirious, never consider that any restraint will be sufficiently effectual to allow of leaving her unwatched, for, under such conditions, patients are often temporarily exceedingly strong and very cunning in devising means of unfastening restraining appliances.

4. When restraining the arms and legs be careful not to make the apparatus tight enough to impede the circulation.

5. If the appliances used are not well padded and lined with a soft material, put some non-absorbent cotton or other soft stuff between them and the skin, especially at the edges, otherwise chafing and ulceration may result.

6. If the patient is struggling keep constant watch to see that such padding does not become displaced or the restraint tightened.

7. Do not fasten the arms and legs in an uncomfortable position.

8. Do not fasten the restraint where the patient can reach the knot or buckle, etc.

9. If possible to avoid it, do not apply restraint over the chest and when a camisole is used arrange it loosely enough over this area not to interfere with free respiratory movements.

10. Feel the pulse of a delirious patient who is struggling against restraint frequently and watch her general condition carefully, for sudden death is a common result of this state, the extra work thrown upon the heart by the violent movements producing conditions incompatible with its functioning.

The appliances commonly provided in general hospitals for the restraint of violent patients are: (1) the camisole or strait-jacket[1]; (2) leather cuffs which

[1] A form of camisole in common use consists of a heavy, but soft, canvas sheet the width of, but about ten inches shorter than, the bed. It is made shorter than the mattress in order not to press upon the patient's feet. It has an opening for the head, and there are sleeves, each one of which has a long strip extending from its under surface that reaches, and can be fastened, to the foot of the bed; there are holes along the upper and side borders through which a heavy cord can be passed to lace the camisole to bars at the sides and top of the bed. There is a slit extending down about twelve inches from the front of the

are of sizes to fit the wrists and ankles and are known as *handcuffs* and *anklets*. Substitutes for these are sheets, a strip of canvas for restraining the thighs,[1] squares of gauze or soft muslin.

Demonstration 32

Methods of Restraining a Delirious Patient

Requisites: A camisole, a pair of handcuffs and anklets, four pieces of gauze, each about one yard square, two draw sheets or one sheet and one canvas thigh restrainer[1] (see footnote preceding page), four soft pads to fit under the handcuffs and anklets, non-absorbent cotton or substitute.[2]

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curve that comes next to the patient's neck so that this portion of the canvas can be thrown back when the doctor wants to listen to the chest sounds. There are eyelet holes on either side of this slit and it is closed by lacing with heavy tape. This should be done before a camisole is put away after use to avoid delay when it is needed, and also the cords with which it is laced to the bed should be attached one in a corner hole at the top, another at the bottom, and two on each side in holes near the center.

Another type of camisole, which is more convenient but less strong and, therefore, less commonly used, consists of two pieces; the upper one of these reaches to the beginning of the pelvis and the lower from the upper part of the thighs to the ankles. It is put on the patient in the same manner as a single-piece one.

[1] A strip of strong, but soft, loosely woven canvas, the width of the mattress and about twenty-seven inches wide with a two-inch hem around its four borders and heavily worked eyelet holes, about six inches apart, along its side borders.

[2] As it is a difficult matter to apply restraint properly it is well for the pupils to take turn being subject for this demonstration, and as soon as the manner of using the appliances is understood, to pretend to resist restraint.

Method 1

Restraint with a Camisole

It would be impossible to give a method of procedure that could be followed in all cases, but the usual order is about as follows:

Make sure that the cords are tied in the eyelets as described in the footnote page 134.

Let one nurse restrain the patient's legs (this, usually, can be done most easily by grasping or leaning upon the thighs just above the knees), while two others put the opening of the camisole over her head and draw her arms through the sleeves.

Pass the top piece under the pillow and lace it to the bar at the top of the bed on a level with or below the mattress, while one assistant fastens the sleeve straps to the foot of the bed and the other continues to restrain the legs. Unless absolutely necessary, the sleeve straps should not be pulled down tightly enough to prevent the patient moving her arms to some extent.

Pull down the lower part of the camisole over the legs, under the sleeve straps; it should not cover the feet. Lace the sides to the side bars of the bed, beginning in the center and working toward the top and the bottom and tie the lower cords to the legs of the bed at the foot. By lacing the camisole in this way either half of it can be undone without loosening the other part.

Method 2

Restraint with Handcuffs, etc.

The handcuffs are strapped around the wrists and the anklets around the ankles and the straps are

locked or otherwise fastened to bars at the sides and foot of the bed. The precautions necessary in their use have been already stated. As a rule it is better to secure the hands first and, after fastening the anklets, to put a double sheet or a canvas restraint across the thighs and knees to prevent the patient making too strenuous leg movements and thus injuring her ankles, but do not, unless absolutely necessary, adjust the straps so closely to the bed that movement of the legs is prevented.

Secure the sheet which you put across the thighs by wrapping its side ends around the bar at the sides of the bed. To do this, pass one side of the sheet between the mattress and the bar, bring it around the bar, and shove its end under and again around the bar, under the first circle of the sheet. Have your assistant do likewise, at the same time, on the other side of the bed.

If the canvas thigh restraint is used, instead of the sheet, put the canvas across the thighs and knees, lace it to the bar at one side of the bed (while your assistant does likewise on the other), by twisting the cord around the bar before putting it into each successive eyelet hole. Begin in the center and work toward the head and the foot. Put the cord through the holes at the upper and lower edges of the canvas twice and then pass them to the head and foot of the bed and tie them to the bars there or to the legs of the bed. This is to keep the canvas stretched and prevent it wrinkling.

In addition to the above restraint, that of the shoulders may be also necessary to prevent the patient sitting up and pulling too forcibly upon her wrists.

To do this, if there is no regular appliance, fold a

sheet cornerwise, take hold of one corner, and have your assistant take hold of the opposite one on the top of the fold. Twirl the sheet in opposite directions until the free corner is twisted around the fold and a straight band is formed.

Pass this under the patient's shoulders; bring the end of the sheet up under an axilla, while your assistant does likewise on the other side, pass these ends over the shoulders under the band, cross them under the pillow, and tie them to a bar at the head of the bed on, or below, the level of the mattress.

Method 3

Substitute Squares of Gauze or Soft, but Strong, Muslin for the Cuffs and Anklets

Fold a square cornerwise and then fold the corner around the fold until a straight band is formed.[1] Make two loops, as in Fig. 18, forming the figure eight with both ends on top and extending in opposite directions; put the loops together and pass them over a hand; put a soft pad or piece of non-absorbent cotton or other soft material around the part under the loops; draw the ends of the gauze until the loops are small enough to prevent the hand being pulled through, but not tight enough to interfere with the circulation.[2] Tie the ends together about twelve

[1] When a band is made in this way the material is on the bias and it does not become as tight as a straight piece does if the patient struggles. N. B.—A bandage should not be used for this purpose.

[2] If it is too tight the parts below the restraint soon become a deep red. Even when the clove hitch is properly tied, the gauze may become somewhat tightened if the patient struggles violently and thus the color of the hands and feet is to be constantly observed.

inches from the wrist and then tie them to the bed. This method of tying is known as the *clove hitch*. The

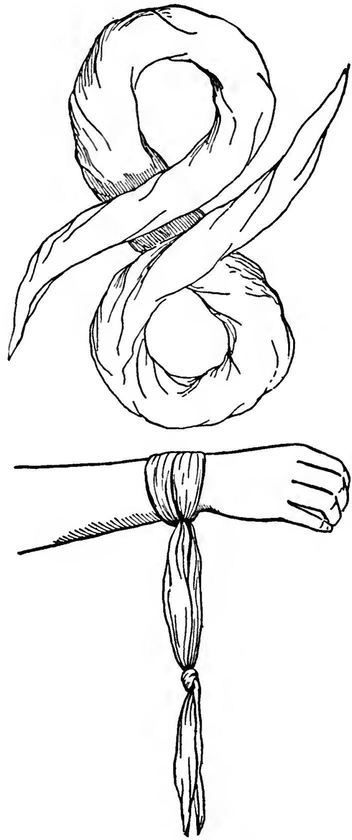

Fig. 18. Clove hitch.

directions must be followed carefully, for if the loops are not properly adjusted, they will either become tightened and interfere with the circulation in the part or else they will not hold.

While you are tying one hand have one of your assistants secure the other one and have your second assistant restrain the legs as in Method 1, or, if you have three assistants, two of them can be tying the feet in the same manner as the hands.

Adjust the thigh and shoulder restraints in the same way as in Method 2.

Method 4

Types of Slight Restraint

As stated on page 132, a simple restraint that will only interfere with the patient's movements sufficiently to give the nurse time to get to her before she can get out of bed is often all that is needed. Two forms of such restraint are: (1) A sheet or canvas put across the thighs as described in Method 2; (2) boards, painted the color of the bed, about one inch thick, fourteen inches high, and the length of the bed, with either hooks or bolts which can be fastened to the bed or a hole in each corner through which a piece of cord can be passed to tie the boards to the bed. The boards are adjusted like the sides of an infant's crib.

Demonstration 33

Restraint of Children with Camisoles

Equipment: Bradford frame, camisoles.

It can be easily appreciated that the precautions mentioned at the beginning of the section on restraint are especially important in the case of children, both because children are more easily excited and injured than adults and because it is very often necessary to

apply some form of restraint when they are not delirious. In the latter case precaution two is of special importance for, if a child can move her arms and the restraint does not bind her uncomfortably, she usually soon becomes accustomed to it. If restraint is likely to be needed after operation it should be arranged before the child recovers consciousness as she is then less likely to notice it.

A light camisole, either with or without the Bradford frame, is probably one of the best means of restraining a child to prevent it getting out of bed or moving too freely. The camisoles generally used without a frame are about the same as those employed for adults, but, of course, smaller, and, as they do not need to be as strong, of softer canvas. Usually they, especially the one-piece ones, are without sleeves for they restrain the child's body sufficiently to allow of its hands being free.

The **Bradford frame** consists of a frame of two inches in diameter gas piping. Hospitals in which it is used are generally equipped with different sizes, for a frame should be just a little bit larger than the child for which it is used. The advantage of the frame for restraint is that, as the bars come nearer the child than do those of the bed, it is possible to adjust the camisole quite loosely across the body and yet get adequate restraint. The only necessary difference in the camisoles used with the frame is that they are smaller, being required to fit the frame. They are laced to the frame as the others are to the bed bars. If the child is very restless or strong, tie the frame to the bed.

A good form of simple restraint for a child is that known as the *supinator*. It consists of a square, about

ten inches, of doubled soft canvas, stitched around the edges and provided with four straps of strong, flat webbing, about two inches in width, which extend from the sides. Two of these straps are comparatively short, being just about long enough, when the square is in position under the child's back, to go across the chest and buckle to the square at one side. The other two straps extend across,[1] and beyond both sides of, the square and one end of each strap is long enough to be passed under the bed and buckle to the shorter end at the side of the bed. If the straps need to be adjusted at all tightly around the chest, put a pad of soft material under them, and always fasten some soft material around the buckles.

Demonstration 34

Restraint of Child's Arm

Equipment: Canvas yoke and sleeves, padded splint about three inches long, non-absorbent cotton, bandage, cuffs.

It is sometimes necessary to restrain a child's arm in order to prevent it pulling off its dressing or the like and various devices have been contrived for the purpose. Three very commonly used are:

(1) A short yoke of canvas (which slips over the head) with sleeves. On the under surface of the sleeves are loops through which a cord can be passed. Each cord is tied to the side of the bed in such fashion that the child can move its arms as freely as possible without reaching its dressing.

[1] The webbing for these two straps is not stitched to the extreme edge of the square as the latter comes up slightly around the chest at the sides.

(2) A well padded splint is bandaged to the anterior surface of each arm in such a way that the child cannot bend its elbows. N. B.—Pad the edges of the splints particularly well.

(3) Cuffs of pasteboard are tied around the upper arm in such fashion that they extend over the elbow and prevent the child bending the latter. Some soft material, as flannelet, should be sewn over the edges of the cuffs or else a thin layer of non-absorbent cotton put between them and the arm.

Demonstration 35

Care after Death

The objects aimed at in deciding the details of this work were: (1) To arrange the body in a suitable position before *rigor mortis*[1] sets in; (2) to prevent unnecessary discoloration of parts of the body that show, especially the face; (3) to have the body clean and to protect it and anything upon which it is laid from post-mortem discharges; (4) the easy identification of the body by the undertaker and others concerned; (5) the prompt notification of those who are to be told of the death.

Naturally there is considerable variation in the methods used in different hospitals, especially regarding the notification of those concerned and the final disposition of the body and the clothes and valuables that the patient possessed. As failure to attend to details of routine procedure in this connection may cause much trouble and annoyance, the pupils should

[1] What is meant by rigor mortis? To what is it supposed to be due? If unable to answer see in textbook of Physiology.

make special endeavor to remember all such information they are given with this demonstration.[1]

Requisites: A sheet, a shroud, a piece of coarse or old muslin about one yard square, a pad of cotton waste, a little loose cotton waste, a four-inch bandage, two safety pins, two tags, vaseline, basin of water, washcloth, towel, comb, two pillows, unless there are two on the bed.

Procedure:[2] Raise the head and shoulders on two pillows.

Close the eyes tightly and, to keep them closed, put a wet pledget of cotton over the lids.

Straighten the legs; put a little cotton waste against the rectum; fold the arms upon the chest.

If the patient had false teeth, put them in; close the mouth and, to keep it closed, take a doubled strip of four-inch bandage, put it under the chin, and tie it on top of the head; bring it up behind the ears if possible to do so and keep the mouth closed;[3]

[1] The hospital rule regarding the summoning of friends and relatives when a patient is in danger of death is another point of the greatest importance for the pupils to understand and put into practice when occasion arises. The common rule is that the nurse in charge of the floor at the time, after getting the doctor's permission, notifies the office of the patient's condition. As a long time may elapse between the date of instruction and the need for some of the pupils to attend to this duty, it is likely to be forgotten unless its importance is sufficiently appreciated, especially as, when a patient becomes suddenly worse, there is usually a great deal of extra treatment to be attended to.

[2] In a real case, if the doctor is not present, word should be sent to him as soon as the patient stops breathing.

[3] Carrying out this demonstration with the hospital doll for a subject is a help to remembering procedure but does not give any idea of its difficulties. To get the mouth to stay closed, for example, is often a very difficult matter but it can and must be done.

place the rolled bandage under the chin; this is removed later, but it helps to keep the mouth shut and thus eliminates the necessity of tying the bandage tightly, which is to be avoided as it tends to produce discoloration.

Remove any rings or other valuables and see that they are at once disposed of according to the hospital rules.

Remove the pillows, except one small one, and proceed to wash the body; be sure to get it perfectly clean, including the finger and toe nails.

Lubricate the eyelids, and around the eyes and lips with vaseline.

Comb and arrange the hair.[1]

If there is a wound, remove the dressing and apply clean gauze; cover this with adhesive plaster.

Fold the muslin square cornerwise, put the pad in the center, and pass them under the buttocks; arrange the pad closely against the rectum, pin the square around the loins like a child's diaper.

Tie the legs together at the ankles and knees.

Put on the shroud.[2]

Put the sheet under the body, letting it extend an equal distance above and below the body.

Tie the arms together to keep them in position when the body is moved.

Write the patient's name, the number of the ward, the date and the hour of death on two tags, and tie one to the bandage securing the arms.

[1] The common custom in hospitals is to braid the hair in two plaits and tie these with a bandage, but, in private practice, the nurse is likely to be requested to do the hair in the manner in which it had been ordinarily worn.

[2] A nightgown would be substituted in private practice.

Bring the top of the sheet down over the head, the bottom up over her legs, and the sides across the body. Pin in two places where the pins will hold the upper and lower, as well as the side portions of the sheet. Tie the second tag to the uppermost of the safety pins.

If the truck used for carrying the body from the ward to the morgue has not a cover, put another sheet over the body.

CHAPTER V

Temperature, Pulse, and Respiration Records

Heat production, elimination, and regulation. Care of thermometers. Procedure in taking the temperature. Cause of the pulse. Different factors controlling the heart's action and the character of the pulse. Factors controlling breathing and the interchange of gases in the lungs and tissues in respiration. Conditions to note when counting the breathing. Abnormal types of breathing. Points to be considered in the keeping of clinical charts and records.

Demonstration 36

Taking the Temperature

In preparation for this demonstration the pupils should read the sections in their textbook of Physics describing the nature and manufacture of thermometers, and the sections in their textbook of Physiology dealing with metabolism and heat regulation, for space here will permit the mention of only a few particularly essential points.

Temperature has been defined as the degree of hotness of a body measured according to some chosen scale.

The body temperature of some of the lower forms of animal life varies with that of their environment; thus a frog's temperature in winter may be five degrees centigrade and in summer twenty-five degrees

centigrade or over and the vitality of its tissues will not be impaired by this wide fluctuation. In higher forms of animal life, however, such a fluctuation would be incompatible with life[1] and only in extreme cases does the external temperature cause any decided variation in the internal body temperature. That this is so is due to the fine adjustment of heat production and heat elimination characteristic of the higher forms of animal life.

The chief source of heat production or *thermogenesis* is the oxidation of material derived from food that takes place in the body tissues, especially in the muscles and the secretory glands.[2] Also small amounts of heat are derived from (1) the friction within the body caused by the movements of the muscles, circulation of the blood, and other internal activities; (2) the hot foods and drinks that are taken; (3) by radiation, from sun and from fires.

Heat loss or *thermolysis* is effected chiefly through the skin, but there is a certain amount of loss through the lungs and with the urine and feces. The relative proportion of loss through these different channels under ordinary conditions is about as follows:

By radiation and conduction from the skin, 73.0%.[3]

[1] The normal temperature and the variations that are ordinarily the limit of human beings, endurance will be seen in the table on page 153.

[2] At one time the heart was thought to be the location of thermogenesis. In the seventeenth century a noted physiologist advanced the opinion that heat was produced in the heart by the combining of sulphur and salts of the blood.

[3] The amount of heat lost in this way depends upon the state of the superficial blood-vessels; if these are relaxed there will be an extra amount of blood in the skin and the loss of heat by radiation will be increased, but if these vessels are contracted the opposite conditions prevail.

By evaporation of water from skin, 14.5%.
By expired air, 10.7%.
By urine and feces, 1.8%.

The evaporation of a liter of water requires 536 calories[1] of heat, and a man loses about 930 calories daily in this way, about 530 of which are lost by evaporation of sweat and 400 by evaporation of the water leaving the blood through the lungs.

The regulation of heat generation and loss, i. e., *thermotaxis*, is necessarily a very complicated matter, because metabolism (the process upon which heat production depends), is so complex and is controlled by so many factors.

The principal factors upon which metabolism normally depends are muscular contraction, the hormones[2] of the secretions of the ductless glands,[3] and the nervous system. The parts of the nervous system that are stimulated by changes in the blood temperature and are, as it were, the adjustors controlling the mechanisms which, in turn, regulate the conditions concerned with thermogenesis and thermolysis are known as *heat regulating* or *thermotaxis centers.* These are thought to be situated in the

[1] Calory is the term used to designate the amount of heat and this is estimated by the use of a calorimeter. What is known as the small calory is the amount of heat required to raise the temperature of one gram of water one degree centigrade and a large calory (which is the one referred to in physiology and above) is the amount necessary to raise one kilogram of water one degree centigrade.

[2] Hormones are chemic substances that are produced in certain glands, and, when absorbed by the blood, and carried to other parts, excite those parts to activity.

[3] Glands that produce secretions which are absorbed by the blood and carried to different parts of the body.

parts of the brain known as the *tuber cinereum* and the *corpus striatum*.

The results of muscular work and of a hot and cold environment furnish good examples of the efficiency of thermotaxis in normal conditions. Some of these are: (1) Muscular contraction is one of the most influential factors in producing heat and hard muscular work will soon be associated with increased secretion of sweat, one of the chief agents in the loss of heat; (2) exposure to a hot environment will be followed by diaphoresis and the evaporation of this will prevent an undue rise of temperature (if, however, there is so much humidity in the air that the evaporation of sweat is interfered with[1] the internal body temperature may become so high that conditions inimical to life are produced); (3) when the environment of the body is unusually cold, the muscles contract and the blood is driven to the interior and thus loss of heat by radiation from the skin is prevented and the muscular contraction will result in increased heat production; but (4) as soon as this is greater than normal the heat regulating centers come into play and through their effects upon vasomotor and sudoriferous centers[2] conditions favorable to loss of heat are promoted.

Ordinarily, the balance between heat production and loss is so finely adjusted that except for very slight diurnal fluctuations the temperature remains almost stationary. Normal fluctuations consist in a

[1] Air can take up only certain amounts of moisture, the quantity depending upon the temperature, and thus on a humid day evaporation will not take place.

[2] What are these effects?

slight rise during the day and fall during the night when the muscles are relaxed.

In fever there is a rise of temperature above the normal daily variation and this is accompanied by an increase in the rate of the heart beat and the respiratory movements and an increased katabolism of tissue protein and, consequently, of the amount of nitrogen in the urine, and there is a diminution of the alkalies of the blood.

The rise of temperature is brought about at first by disturbance between the production and loss of heat. The nature of this disturbance varies somewhat as in some cases it is due chiefly to overproduction and in others to interference with loss of heat. This derangement in thermotaxis, however, only lasts for a short time for the heat regulating center eventually again assumes control but, as long as there is fever, the center is set for a higher scale of temperature so that, instead of responding to a temperature between 99° and 100° F. (the ordinary actual temperature of the blood), it is only called into action by a higher temperature, the degree[1] depending upon the cause of the fever and the patient's condition, but, even in fever, there is adjustment. This is much less stable, however, than in health for there are often wider variations in the diurnal fluctuations

[1] The thermotacic center is often likened to the adjustor of an electric oven. If the indicator of the adjustor is set, for example at ninety-eight, so soon as the oven reaches ninety-eight degrees the electric connection is automatically severed by the adjustor and remains so until the temperature falls, when it is again remade by the adjustor, and thus a constant temperature of ninety-eight is maintained in the oven; but if the indicator is set for, say, four hundred, this will be the temperature maintained in the oven.

and changes of external temperature and other stimuli more easily depress or increase the temperature than in health.

The cause for the thermo-regulative upset is not definitely known; one of the theories that has been advanced is that the heat centers are depressed by the action upon them of bacterial toxins, or in non-bacterial diseases, the conditions causing the illness; but it is now thought that there are other factors involved. One theory is that the action of the toxins on the proteins of protoplasm causes their abnormally rapid destruction and thus gives rise to substances that interfere with thermotaxis. It has also been suggested that the toxins produce a constriction of the peripheral blood-vessels which drives the blood to the interior of the body and thus prevents loss of heat.

Such a condition of vaso-constriction is common in fever and some physiologists consider that it is a natural compensatory arrangement to supply the internal organs suffering from the infective process the means to combat the infection. It will be remembered that the main agents of defense against infection that the body has are the phagocytes, opsonins, antitoxins, and antibacterial substances present in the blood.

As a matter of fact, the results of experiments, in which some animals were heated to 40° C., after receiving subcutaneous injections of cultures of different bacteria, and others were given the injections without being so heated, would indicate that the rise of temperature within certain limits may be beneficial for the animals whose bodies were not heated died much sooner than did the others. In severe infec-

tions, however, the temperature and the congestion of the internal organs are likely to become extreme unless means are taken to control these conditions.

The toxins produced by different species of bacteria vary in their action upon the body and thus the symptoms of the different diseases they induce vary. This variation is evident also in the course that the temperature runs and certain diseases give rise to temperatures that show an altogether different course from that produced by other infections. Thus, there are certain definite types of fever and these are classified as *continuous*, *intermittent*, and *remittent* fevers.

A fever is said to be continuous when it remains constantly high with but slight variation in its diurnal fluctuations. Pneumonia, scarlet and typhus fevers are of this type.

In remittent fever, on the contrary, there is a considerable range between the highest and the lowest points, but the temperature, until convalescence begins, is always above normal. Typhoid fever is of this type.

Intermittent fever is marked by very wide ranges between the fluctuations, the temperature alternately rising to 104° F. and over, and then falling to or below normal; malaria is of this type.

When judging of the severity of an infection or other abnormal condition by the temperature it is necessary to know the ordinary course of the temperature in that disease, for examples, a temperature of 103° F. is common in tonsillitis, but would probably indicate a very serious condition in diphtheria, and many patients have recovered from a temperature of 112° F. resulting from heat prostra-

tion but, when the temperature reaches 106° F. as the result of bacterial infection, recovery is rare.

The terms used in describing different degrees of temperature is shown in the following table.

	Fahrenheit	Centigrade
Hyperpyrexia	106 and over	41
High fever	103 - 106	39 -41
Moderate fever	101 - 103	38 -39
Subfebrile	99 - 101	37 -38
Normal	98 - 99	36.5-37
Subnormal	97 - 96	36 -35.5
Collapse	96 - 95	35.5-35
Algid collapse	Below 95	35

There are three stages in the course of a fever, viz.:

1. Invasion or onset, the period in which the temperature rises until it reaches its maximum. This may occur suddenly, as in pneumonia, or slowly, as in typhoid.

2. Fastigium, or stadium, the period in which, though there may be marked variations, the temperature remains more or less the same and repeatedly touches its highest point.

3. Defervescence, the period in which the temperature falls until it reaches the normal.

The period of defervescence may be very short, and the fever is then said to terminate by *crisis*, or it may be prolonged in which case the fever is said to terminate by *lysis*.

Care of thermometers: When thermometers are in constant use they are best kept in a disinfectant. Bichlorid of mercury 1–1000, is very commonly used for the purpose because it is an efficient disinfectant and it is odorless and almost tasteless. A soft thin pad of cotton must be in the bottom of the glass

because the bulb of the thermometer is of very thin glass and is easily broken. The disinfectant and pad must be changed twice daily. The glass used to hold the thermometers must be deep enough to allow of the disinfectant coming to within one inch of the top of the thermometer.

Thermometers used for taking rectal temperatures must be kept separate from those for the mouth and they should have some distinguishing mark.

The bulbs of the cheaper grades of thermometers generally used in hospitals gradually contract and the thermometers then register incorrectly. For this reason those in use should be tested weekly. This is done by putting them into a glass of hot water (about 108°[1] F.) with a thermometer that is known to be accurate, leaving them about three minutes and then comparing them with the standard. Those which show any considerable variation should be given to the head nurse. They can, as a rule, be returned to the makers.

Clinical thermometers are self-registering—*i. e.*, the mercury stays at the height to which it ascends until it is shaken down. Therefore, before using a thermometer, it is necessary to see if the mercury is down to 95° F. and if not to shake it down to that point.

To shake down the mercury, hold the thermometer between the thumb and the first and second fingers of the right hand, with the bulb pointing downward,[2]

[1] The temperature of the water must not exceed the highest point of the scale on the thermometer.

[2] Do not let the bulb of the thermometer extend far beyond the hand for, if it does, it may knock against something or the thermometer may slip from the hand.

flex the hand somewhat and give it a quick, sharp jerk. Be careful not to shake the mercury below 95° for if it all gets into the bulb it may not be possible to make it rise again. To try and make it do so, put the bulb into water about 108° F.

The temperature is taken in either the mouth, rectum, or axilla, for these locations form more or less closed cavities in which large blood-vessels approach the surface. For obvious reasons, the temperature taken by rectum will be registered about a degree higher, and that taken by axilla about ½ degree lower, than that taken by mouth. It is necessary to leave the thermometer in place for a longer time when it is put in the axilla than when it is inserted in the rectum or mouth.

There is less chance of error when the temperature is taken by rectum and thus it usually is taken in this way when a patient is very ill, except when there are abnormal conditions of the rectum.

Requisites for demonstration:

1. A clinical thermometer for the instructor and one for each pupil.

2. A tray with the equipment used when taking temperatures in the wards.[1]

[1] (a) A common equipment consists of a tall glass with a pad in the bottom and sufficiently full of solution to cover the six thermometers which it holds to within one inch of their tops.

(b) A colored glass with the same contents for rectal thermometers.

(c) A jar of vaseline.

(d) A jar with small gauze or cotton wipes.

(e) A book or pad and, attached with a string, a pencil. Each temperature is recorded in this book as soon as the thermometer is read, and after all the temperatures have been taken they are copied from the book on the patients' charts.

3. A tray with an individual equipment.[1]
4. A towel.

Procedure when taking the temperature by mouth. Take the thermometer from the solution, wipe it,[2] shake it down if necessary, as described on page 154, place it, in a slanting position, under the tongue. Tell the patient to keep her mouth tightly closed. Leave it in place three minutes. Remove it, wipe it, read it, put it in the solution.

Record the temperature.

If the temperature does not seem to accord with the patient's condition take it with another thermometer, and, especially if the patient is inclined to be hysterical, watch her, for such patients often get an unduly high record by moving the thermometer in the mouth, holding it on a hot-water bag, and by various other means.

Report any abnormal temperature to the nurse in charge.

Points to remember: A mouth temperature should not be taken within ten minutes of the time that the patient has had anything hot or cold in the mouth.

The temperature is not to be taken by mouth when the patient is coughing, has dyspnea, is unconscious, delirious, insane, or too young to understand what she is to do.

[1] A tray, with one thermometer, either rectal or mouth, depending upon which is needed for the patient, a small jar of vaseline if a rectal thermometer is used, and a small jar of pledgets, is generally kept in each room intended for private patients and in the ward for patients who have infectious diseases.

[2] When the same thermometer is used for a number of patients a different wipe must be used for wiping it after it is removed from the mouth than before inserting it, or else a different wipe must be used for each patient.

Do not leave the thermometer in the mouth longer than three minutes.

Should a patient bite the bulb off the thermometer, make her at once spit out the glass and mercury and be sure that no particles are left in her mouth. The physician should be notified. The danger attending this accident is that small particles of glass may be swallowed. Mercury in its metallic form is inert and, therefore, would probably do no harm, even if swallowed, but white of egg, which contains albumen, the chemical antidote for mercury, is usually given as a precautionary measure.

Procedure when taking rectal temperatures: Shake down the mercury, lubricate the bulb, insert it gently into the rectum, for about one inch, pointing it slightly backward, and allow it to remain for three minutes. Proceed as when taking the temperature by mouth.

If the patient is a small child hold it, if possible, face downward, across your lap, for it is easily restrained in this position and more likely not to need restraint than if it is in bed. As the axis of the rectum is changed when the child is in this position, the thermometer must be inserted pointing toward the umbilicus.

If the child remains in bed, it can lie either on its back or side; if it struggles, flex its thighs against the abdomen, keep one arm across its body and grasp it around its knees; hold the thermometer in place with your free hand.

Points to remember: The temperature is not taken by rectum following operation upon the rectum or when it is diseased. Never allow a very sick patient to insert the thermometer herself. If, when the thermometer is removed, the bulb is coated with

feces, put a rubber cot on your finger, remove the feces from the rectum, and take the temperature over again for, if the bulb is embedded in a mass of feces it is the temperature of the decomposing fecal matter, and not that of the blood, that is obtained.

Procedure in taking the temperature by axilla: Wipe the axilla with a towel. Shake down the mercury.

Place the bulb of the thermometer in the hollow of the axilla with the stem pointing toward the chest, bring the arm under which you place the thermometer across the chest, and instruct the patient to hold it pressed closely to her body; unless she can do so without undue effort, keep your hand upon her arm.

Remove, wipe, and read the thermometer, put it in the disinfectant, and record the temperature at once.

Demonstration 37

Counting the Pulse

By the pulse is meant the distention of the arteries that occurs when blood is forced into them (via the aorta) with each contraction (systole) of the left ventricle of the heart.

Some essential physiological facts regarding the circulation that it will be well to recall, before considering the procedure of this demonstration, are as follows:

For the heart to do its work properly the nervous mechanisms supplying it and the blood-vessels must be normal and must be receiving normal stimuli; the heart muscle must be in a state of normal tone[1]

[1] The state of slight contraction characteristic of all normal muscle. Lack of tone in the muscle tissue of any organ will

(otherwise it will not contract properly), its degree of irritability (*i. e.*, power of responding to stimuli) must be normal, the avenues by which the impulses are conducted from the pacemaker (the sinus node, referred to later) to all parts of the heart must be normal; the condition of the valves must be fairly normal[1]; there must be a normal degree of resistance offered to the heart by the blood-vessels.

The alternate contraction and relaxing of the heart is maintained by the sodium potassium and calcium salts of the blood, for, when these salts are in solution together, in definite proportion, the sodium and potassium promote contraction and calcium induces relaxation of heart muscle.

The rate of the heart action, however, is regulated by its nerve supply, and it is now generally supposed that the stimulus regulating contraction is received in an area of the wall of the right ventrical that has been named the *sinus node*, and that from this impulses are given to the auricles and from the auricles they pass over a strand of fibers known as the *bundle of His* to the ventricles.

In response to the stimuli the two auricles contract

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interfere with the normal functioning of the organ. Tone is maintained by nerve impulses and thus anything which depresses the nervous system will lower muscle tone.

[1] An attack of endocarditis is very likely to leave some permanent injury of the valves but, if this is not excessive, and the patient is properly treated, the heart will enlarge and its walls become thicker so that it will be able to overcome the resistance to its action that the injury gives rise to. A heart in such condition is said to be *compensated*. Such a heart cannot stand as much strain as a normal heart and excitement, active exercise, illness, will easily bring about abnormal conditions and there is then said to be *failure of compensation*.

(forcing the blood they contain into the ventricles) and their contraction is followed in about, if the pulse rate is normal, one fifth of a second by the simultaneous contraction of the two ventricles with the consequent expulsion of blood into the aorta and the pulmonary artery. As the ventricles contract the auricles[1] relax and, after the ventricles have ejected the blood forced into them by the auricles, they do likewise.

The contraction of the heart is known as its *systole;* its period of relaxation is termed its *diastole*, and there is a short period during which all the heart is at rest which is known as its *diastasis*.

The alternate contraction and relaxation of the heart is known as a *cardiac cycle*. The time occupied by each part of a cycle, when the heart is beating seventy-five times per minute, is about as follows:

Auricular systole	0.1 of a second
Auricular diastole	0.7 of a second
Ventricular systole	0.3 of a second
Ventricular diastole	0.5 of a second
Diastasis 0.2 to 0.3 of the diastole	

It can be seen by the table that there is only 0.4 of a second during each cycle in which the whole heart is in diastole and but 0.1 to 0.2 of a second in which it is at rest. Important points to remember in this connection are: (1) That it is during diastole that the heart muscle gets its necessary nourishment and oxygen because it gets these from the blood in the

[1] Through what vessels does the blood empty into the right and left ventricles?

Name the valves between the right and left auricles and ventricles and between the ventricles and the aorta and pulmonary artery.

coronary vessels and, when the heart contracts, the blood is forced from these vessels. (2) It is the time of diastole that is shortened when the rate of the heart action is increased.

The nerve fibers supplying the heart and regulating the rate of its action are from two sources: (1) Masses of gray matter in the medulla oblongata—known as the vagus centers, and (2) from cerebral centers and from ganglia that belong to what is commonly called the *sympathetic division of the autonomic nervous system.*

The impulses coming from these two sources oppose the action one of the other; vagus impulses tending to retard or inhibit the heart action and sympathetic impulses to accelerate it. Therefore, if the vagus nerve fibers or centers are depressed or if the sympathetic fibers or centers are stimulated the heart action will be quickened, while if the vagus is stimulated or the sympathetic depressed the heart action will be slowed.

The sympathetic system is stimulated by such things as excitement, fear, anger, intense interest, etc., and if the pulse is counted while a person is under the influence of such stimuli an accurate knowledge of its actual rate will not be obtained. The sympathetic system is also stimulated by pain, and conditions causing fever, and certain drugs, and there are drugs that increase the pulse rate by depressing the vagus and reducing blood pressure (referred to later) and intense heat, as in hot baths, will do so from this cause.

The pulse is increased also by active exercise and even by change of position from lying to sitting and from sitting to standing. Even in health the pulse may be as much as five beats more per minute when sitting than when recumbent and ten more when

standing. Thus a patient's heart may be spared at least 21,600 beats a day if she is kept quiet. One reason for the increase in the frequency of the pulse by change in position is that when a person is in an upright attitude the blood has to be forced to the parts above the heart against gravity, which is not the case in the recumbent position.

Persons with nervous temperaments are likely to have a quicker pulse rate than those who are more phlegmatic, and as will be seen by the table on page 163 the pulse is normally more rapid in infancy than in childhood, and in childhood then in adult life, until about sixty years of age when it again becomes more rapid. It is quicker in the female than in the male and, as a rule, the pulse rate has an inverse relation to the stature being relatively slower in tall than in short people.

Acceleration of the pulse rate by natural causes as temperament, exercise, change of position, medicinal doses of drugs, is spoken of as *physiological frequency*, and acceleration due to abnormal causes as *pathological frequency*. Continued frequency of the pulse from any cause is termed *tachycardia*.

Physiological infrequency or slowing of the pulse is not common but it is noted after fasting, it is normal in some individuals even in health, and it is produced by drugs which stimulate the vagus system and visceral muscle and those which act as nerve sedatives. If the infrequency due to drugs is excessive it is considered a pathological cause. Other pathological causes are mentioned on page 163. Infrequency of the pulse is termed *bradycardia*.

The average frequency of the normal pulse is as follows:

In men....................	67– 70	beats per minute
" women....	65– 80	" " "
" children above 7 yrs......	72– 90	" " "
" children 1–7 yrs.........	80–120	" " "
" infants.................	110–130	" " "
At birth....................	130–160	" " "

When there is a high temperature the condition causing the rise will, as already stated, affect some of the parts controlling the circulation, but except in certain diseases there will be, so long as the patient is doing well, a fairly definite ratio of pulse to temperature, which for an adult is about as follows:

For a temperature of	100° F. a pulse of	80– 90
" " " "	102° F. " " "	100–110
" " " "	104° F. " " "	120–130

Exceptions to the rule are scarlet fever, septicemia, exophthalmic goiter, hysteria, neurasthenia, and some forms of heart disease, in which, normally the pulse ratio is nearly always disproportionately frequent; and yellow fever, myxedema, certain toxemias as uremia, and some organic heart diseases, in which the pulse is relatively infrequent.

Any very considerable **disproportionate increase** of the pulse rate that cannot be counted for by the conditions already mentioned is likely to be due to some such cause as collapse or shock, hemorrhage, poisoning by drugs; even drugs which are used to slow the heart action may, in poisonous doses, have the reverse action.

Two common causes of disproportionate infrequency other than those mentioned are: (1) Pressure at the base of the brain which affects the vagus center; such pressure may be due to inflammation, and is particularly likely to occur in meningitis, tumors, etc.,

hemorrhage, fracture. (2) Overdosing by drugs that stimulate the vagus mechanism.

Occasionally the arterial pulse will be very slow, about thirty a minute, while the auricles will be beating at the normal rate. Such a condition is due to what is termed *heart-block* and it results from defective conductivity of the bundle of His. This may be brought about by overdoses of digitalis and drugs with similar action, by infectious toxemias, and from local lesions of the bundle.

In addition to counting the pulsations of an artery, and thus ascertaining the frequency of the heart action, a nurse, when, to use the common expression, "taking the pulse" should note (1) whether it is regular or irregular, (2) its force, (3) if it is dicrotic, (4) if it is easily compressed or if the tension is greater than normal.

The normal pulse is regular in force and frequency —*i. e.*, the pulsations are all of almost equal strength and the intervals between pulsations are of equal length. The pulse is likely to become irregular in either or both force or frequency when the heart is weakened from any cause. Another common form of irregularity is what is known as an *intermittent pulse*. By this is meant that, at either regular or irregular intervals, there is an intermission of pulsation due to failure of the heart to contract properly. When this occurs in the course of disease it usually indicates a relaxed condition of the arteries or a weakened heart, but it sometimes occurs in comparatively healthy individuals, especially the aged, and those who smoke a great deal or who are addicted to the excessive use of tea, coffee, alcohol, and drugs which affect the nervous system.

By the force of the pulse is meant its strength, whether it is strong or weak. The strength of the pulse beat is dependent upon the conditions influencing blood pressure.

A pulse is said to be dicrotic when some of the pulsations are, as it were, divided, the second part of the beat being weaker than the first. It occurs sometimes when the tone of the arterial walls is below normal, because, on account of its relaxed condition, the aorta fails to contract properly when the blood is forced into it from the ventricles and then, when it becomes distended with blood, it contracts suddenly and forces the blood back against the semilunar valves; this backward flow closes the valves and, consequently the blood is forced onward through the arteries and gives rise to the second pulsation. As the two beats of a dicrotic pulse represent but one contraction of the heart they are to be counted as one. When in doubt as to whether a pulse is dicrotic or irregular in force, count the apex-beat.

The degree of pressure that the blood will exert upon the walls of the blood-vessels depends upon several factors, the principal ones being the pumping capacity of the heart, the amount of blood in the arteries, and the degree of resistance offered to the onward flow of the blood.

Conditions upon which the pumping capacity of the heart depend have been already mentioned.

Any lasting alteration of the **amount of blood in the arteries** will be depletion because, if the amount of blood is increased above the normal by the excessive intake of fluid, the kidneys will be stimulated and, if they are in normal condition, diuresis will result and the extra fluid will thus be gotten rid of;

and, if the kidneys are diseased and do not get rid of the excess fluid, it will pass into the tissues or body cavities. The main causes of lessening of the amount of blood in the arteries are: Hemorrhage, continued severe purging, such as occurs in cholera, and relaxation of the splanchnic (visceral) vessels. The abdominal organs are very liberally supplied with blood-vessels that are controlled by vaso-constrictor nerves[1] and, if these are depressed, the vessels can become so relaxed that they will hold almost the entire blood supply of the body. This is the condition that exists in shock and the blood pressure is then exceedingly low.

The conditions of the blood-vessels upon which their resistance to the heart's action depend are the softness or hardness and degree of elasticity of their walls and the caliber of the vessels. Conditions which increase resistance cause a high blood pressure and those which reduce it below normal, a low pressure.

The blood-vessels are usually softer and the blood pressure thus lower in women than in men and in children than in adults; in fact, they are gradually becoming firmer all through life and in old age a condition known as *arteriosclerosis* exists. When sclerosis advances gradually and is not excessive the heart accommodates itself to the extra work but, if it is excessive, heart dilatation and failure may result.

Common causes of excessive and premature sclerosis (hardening) of the vessels are: The toxins of infectious diseases, especially those of syphilis; the excessive use of alcohol; autointoxication which may be brought about by (a) absorption of products of excessive

[1] The nerves, which cause the contraction of the blood-vessels.

putrefaction from the intestine; (b) defective metabolism, or (c) disease of the kidneys which interferes with the elimination of waste matter.

When this condition exists the tension of the pulse will usually be high, *i. e.*, it will take an unusual amount of pressure upon a vessel to obliterate the beat, and the pulse is spoken of as being of *high tension* or *incompressible.* Even when the arterial walls are hardened, however, the pressure will become reduced, even to the point of causing death, if the caliber of the vessels is relaxed.

The caliber of the vessels is chiefly dependent upon the action of the vasoconstrictor nerves.[1, 2] If any part of the vasoconstrictor mechanism is stimulated the vessels supplied with vasoconstrictor fibers become contracted to a greater degree than usual and, naturally, the blood pressure is then raised; depression of the vasoconstrictor mechanism, on the contrary, will allow of relaxation of the vessels and fall of blood pressure.

Common causes of stimulation of the vasoconstrictor mechanism and thus of a rise of blood pressure are: Excitement, exposure to cold, muscular exercise, pain if not severe enough to cause shock, the conditions existing in the preliminary stages of febrile diseases; and certain drugs, notably, adrenalin, digitalis, and other drugs with similar action.

[1] The caliber of the vessels can also be changed by drugs which stimulate (*e. g.*, pituitrin) or depress visceral muscle.

[2] All blood-vessels except, some physiologists think, the coronary (those supplying the heart muscle), those of the brain, lungs, and perhaps some in the skin are supplied with vasoconstrictor nerve fibers but the only vessels known to be supplied with vasodilators are those of the secretory glands, and some of those in the muscles, genitals, and the skin of the face and neck.

The pulse, when blood pressure is raised in this way becomes full and sometimes what is usually described as bounding. Contraction of the blood-vessels can also be brought about by direct stimulation of the muscle tissue of their walls. This is the way in which pituitrin acts.

Common causes of depression of the vasoconstrictors are fright, severe pain, extreme nausea or diarrhea, exposure to intense heat, as in hot baths; fatigue; anemia of the brain; loss of muscle tone, such as is brought about by disease and malnutrition; over stimulation of the nervous system from any cause; drugs which depress the nervous system and even those which are nerve stimulants in poisonous doses. The pulse under such circumstances will become feeble, frequent, and compressible.

The estimates of the degree of blood pressure made by pressing the fingers on the artery are not either definite or very accurate and nowadays either a cardiograph or a sphygmomanometer, especially the latter, is generally used in all cases in which alterations of pressure are of special importance.

There are several varieties of both these appliances. **The essentials of a cardiograph are:** A mechanism that will be set in motion by the pulsation of the heart, or of an artery over which it is placed, and to which is attached a stylus that will make marks on a carbon paper fitted over a disk when this is made to revolve under the stylus. These marks will correspond to the pulsations that set the mechanism in motion. Fig. 19 shows the marks made by such an instrument when used over a pulse that was dicrotic.

A form of sphygmomanometer in common use consists of (1) an elastic bag outside of which is a

leather cuff; (2) a mercury manometer (Fig. 20), which is connected with the elastic bag by means of rubber tubing, and also with (3) an air pump.

This is adjusted and used as follows: The elastic bag, covered with the cuff, is strapped around the arm at the heart level and then, by use of the pump, inflated until no pulsation can be felt at the radial

Fig. 19. Tracing of a dicrotic pulse made with a sphygmograph.

artery. The height at which the mercury stands is then read and this represents the maximum or systolic pressure. The pressure on the arm is then reduced, by liberation of some of the air in the bag, until a large bounding pulse occurs[1]; the height of the mercury when this happens marks the diastolic pressure, *i. e.*, the pressure that the blood is exerting on the walls of the blood-vessels during diastole, this naturally is not as great as the systolic.

Another variety of sphygmomanometer that is much used has, in addition to the parts enumerated in the other type, a stethoscope. The disc of the stethoscope is placed over the brachial artery in the bend of the elbow and is held in place by the lower edge of the cuff. The examiner puts the ear-piece

in his ear and the pressure, instead of being judged by feeling the radial pulse, is judged by the sounds heard, thus, as the bag is inflated, the level immediately below the top of the mercury column when the first sound is heard gives the diastolic pressure.

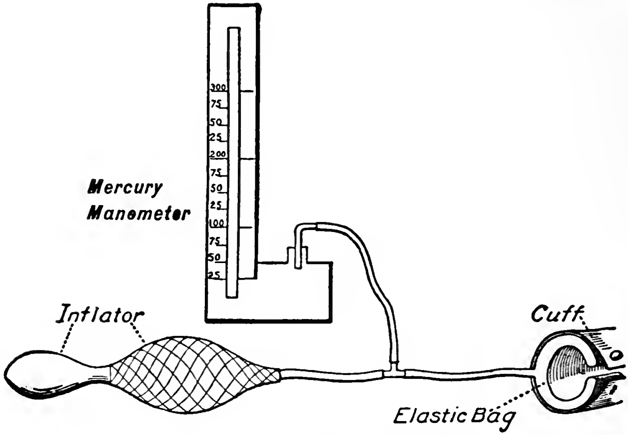

Fig. 20. Sphygmomanometer.

As the inflation of the bag is increased the sounds first grow and then decrease and finally, when the vessel is closed, cease. After a few additional squeezes of the pump, the air is allowed to escape slowly and the mercurial level (minus 1 mm.) when the first sound is heard gives the systolic pressure.

The scale of the manometer is marked in millimeters (mm.) and thus the degree of blood pressure is stated

[1] Sometimes the diastolic pressure is judged by the oscillations of the mercury rather than the pulse. In such case the pressure is released until the widest oscillations of the mercury column are obtained and the lowest position of the mercury meniscus is taken as the diastolic pressure.

as being the number of millimeters that it raises the mercury in the manometer.

The normal degree for the systolic pressure of a man between twenty-five and forty ranges from 110 to 145 mm. the average being 125 to 130 mm. **The normal diastolic pressure ranges** from 20 to 40 mm. below the systolic.

The blood pressure in women is about 10 mm. lower than in men, and in children about 10 mm. below that in women.

Systolic pressure is the greatest pressure which the contraction of the heart causes in the artery used for the test.

Diastolic pressure is the lowest point to which the pressure drops between beats, *i. e.*, during diastole, and it shows the degree of resistance against which the heart has to work.

What is called **the pulse pressure** is the difference between the systolic and diastolic reading; *e. g.*, if the systolic pressure is 135 and the diastolic 110 the pulse pressure will be 25. The pulse pressure is an indication of how well the heart is driving the blood through the vessels.

What is spoken of as the **co-efficient of pressure** is obtained by dividing the pulse pressure by the systolic and it is said to give an idea of the efficiency of the heart's action. The normal co-efficient is 0.33 to 0.25 and a co-efficient of or below 0.20 means a weakly acting heart.

Water-hammer-pulse: An abnormal condition of the pulse that it is well for nurses to know about is that termed *water-hammer-pulse* or *Corrigan's pulse.* The first name was given it because it is characterized by a quick powerful beat which suddenly col-

lapses. The pulsations can be seen in the carotids and frequently in the brachial arteries. The conditions which give rise to the pulse are due to disease of the heart which allows of regurgitation of blood from the aorta. The force of the heart is due to the large quantity of blood forced into the aorta by the enlarged ventricle; and the sudden collapse is the result of failure on the part of the diseased valves to hold the blood in the aorta.

Pulsation in some of the large veins, more especially the jugular and those on the back of the hand, is sometimes seen as the result of abnormal conditions of the heart, relaxed arteries, or severe anemia.

Occasionally **pulsations in the capillaries** can be detected when a person has heart disease, exophthalmic goiter, or severe anemia. It is seen most easily in the lip if it is blanched by pressing a glass slide upon it. A nurse would not be expected to recognize a capillary pulse; it is merely mentioned as a matter of interest.

Requisites for demonstration:

A watch with a second hand for each pupil.

A pad and pencil for each pupil.

A stethoscope.

A sphygmomanometer.[1]

The members of the class act as subjects for each other.

The pulse can be counted and its character observed

[1] It is well for pupils to learn to count the apex beat with the aid of the stethoscope.

Though the blood pressure is usually taken by the doctors it is well for nurses to have some idea how to use the sphygmomanometer.

on any large artery that is above a bone[1] where it approaches the surface. For examples: (1) The radial arteries at the wrist, on the thumb side; (2) the facial arteries where they pass over the lower jawbone, which is about on a line with the angles of the mouth; (3) the carotid arteries on the side of the neck; (4) the temporal arteries, a little above and to the outer angles of the eyes; (5) the femoral arteries, where they pass over the pelvic bones; (6) the dorsalis pedis on the dorsum of the foot.

Precautions: Do not "take the pulse" when the patient is excited or other conditions exist which will cause temporary changes in it, except for the purpose of noting the results of such conditions upon it, see page 161.

Do not use your thumb to feel a patient's pulse for there is a superficial artery in it and you might feel your own pulse instead of the patient's.

Do not make too strong pressure when counting the pulse for, if the pulsation is weak, strong pressure will obliterate it—this is a common fault of beginners.

When taking the pulse at the radial artery, let the patient's arm rest on the bed or a table.

When taking the pulse of a patient for the first time always take it in both wrists to ascertain if it can be felt equally well in both for, sometimes, owing to an unusual distribution of the arteries, or of some pathological condition there is an appreciable difference in the quality of the pulsations in the two arteries.

When the pulse seems slower than it should, count the apex beat, preferably using a stethoscope. Reasons for this have been already given. The beat of

[1] A firm background against which pressure can be made is essential.

the apex of the heart will, normally, be heard about an inch below and to the left of the nipple.

Procedure: See that the patient is resting comfortably.

Take your watch in one hand and place two or three fingers over the artery, making slight pressure; observe the general character of the pulse. Count the number of beats occurring in one minute. If there is any suspicion of irregularity of frequency, count four quarters (noting the point on your watch where you begin each quarter) rather than for the whole minute at once; because, for example, if there are sixteen pulsations in one quarter and twenty in another, it will show irregularity of frequency.

Record the rate and if there is any abnormal condition of the pulse make a note of it.

Demonstration 38

Counting the Breathing

Respiration[1] is said to be the *sum total of the processes by means of which the body obtains oxygen and gets rid of the carbon dioxid produced in its tissues.* This includes: (1) The mechanical movements of breathing; (2) the passage of oxygen from the alveoli of the lungs into the capillaries, its union there with the hemoglobin of the red corpuscles and the elimination of carbon dioxid from the capillaries into the alveoli. These processes are known as *external respiration;* (3) the passage of oxygen from the blood into the

[1] Name the organs through which air passes to the lungs.
Describe the lungs.
Name the vessel through which blood comes from the heart to the lungs for aëration.

tissues and the passage of the CO_2 that has been produced by the union of oxygen with material in and of the tissue into the blood and lymph-vessels. This is termed *internal respiration.*

Breathing consists in the alternate expansion and contraction of the chest walls and the lungs. The expansion movements, by means of which air is drawn into the lungs, are known as *inspiration* and the contraction, which forces out the air, as *expiration.*

The regulation of breathing, like all other processes of the body, is very complex and probably dependent upon many factors, but its main regulator is a small mass of gray matter in the medulla oblongata, known as the *respiratory center*, from which nerve fibers extend to the diaphragm and to certain of the muscles of the chest.

Stimuli from this center will: (1) Cause the muscle tissue of the diaphragm to contract, and thus pull the diaphragm downward and flatten it in the center; (2) pull certain of the chest muscles upward or outward. These actions enlarge the chest cavity and a partial vacuum is thereby created between the chest walls and the lungs. The pressure within the lungs is then greater than that around them and the lungs are pressed outward in keeping with the movement of the chest walls. This constitutes inspiration.

Following the inspiratory movements there is an elastic recoil of the muscles which results in the diaphragm again assuming its dome-like shape and the falling back of the ribs to the position they were in before inspiration. This constitutes expiration. At times, especially when there is some obstruction to breathing, or a deficiency of oxygen the expiratory movements are associated with active contraction

of all muscles that will depress the ribs and increase intra-abdominal pressure and thereby push up the diaphragm.

The main stimulus of the respiratory center, and thus of the impulses which cause breathing, is the carbon dioxid in the blood passing through the center and the latter is very sensitive to differences in the amount of CO_2.

Other factors that influence breathing are: Increase in the amount of oxygen in the blood; impulses passing up the vagi[1] fibers supplying the lungs; stimulation of certain of the cutaneous and other nerves that give rise to the phenomena mentioned on pages 177 and 178; differences such as exist in men and women, adults and children. This is seen in the following table which shows the average normal frequency of breathing:

Men	16 to 18	per	minute
Women	18 to 20	"	"
Children	20 to 25	"	"
Infants	30 to 35	"	"

The usual ratio of the breathing to the pulse is about one to four. This ratio is common even in fever unless there are also some of the additional

[1] The vagi centers are in the medulla oblongata, fibers go from them to the heart, lungs, trachea, bronchi, esophagus, stomach, etc.

If the fibers supplying the lungs are cut the breathing becomes less frequent and deeper and acquires a dragging character. These fibers are stimulated at their peripheral endings, *i. e.*, in the lungs. It is thought that the expansion of the lungs sets up influences in some of the fibers which cut short inspiration and that the collapse of the lungs excite fibers which further inspiratory movements.

causes for disturbance mentioned in the paragraphs following.

Increase in the frequency of breathing (polypnea) will be brought about by: (1) Conditions that increase the CO_2 content of the blood, as exercise or anything else that increases the rate of metabolism; (2) increase of CO_2 or deficiency of oxygen in the air; (3) anything that hinders the lungs getting their oxygen supply, as obstruction in, or inflammatory conditions of, the respiratory track, by conditions that interfere with sufficient depth of respiration, as abdominal inflammation or tight corsets; (4) conditions which lessen the oxygen supply of the tissues, shock, hemorrhage, anemia[1]; (5) toxins produced by bacteria and other causes of fever; (6) cold; (7) pain; (8) strong emotion; (9) drugs which stimulate the respiratory center.

Decrease in the rate of breathing is usually due to: (1) Depression of the respiratory center as by opium and other narcotics, the toxins present in the body in uremia, diabetes, and the usual so-called fatigue poisons; (2) during sleep; (3) pressure upon the center as when there is cerebral inflammation, hemorrhage, or fracture; and (4) the intake of an extra amount of oxygen; if, for example, a long breath is taken, it will be followed by a temporary arrest of the breathing, a condition known as *apnea*.

The depth of the inspiratory movements is generally proportionate to the frequency of the breathing, being shallow when the breathing is frequent and deep when it is slow. If conditions giving rise to pain in the abdomen, lungs, or other respiratory organs, or

[1] Why will shock and anemia interfere with the oxygen supply of the tissues?

the chest wall exist, the breathing will become particularly shallow and frequent, unless complications having the reverse effect are also present. In men and children the breathing is usually deeper than in women and the movements of the diaphragm are more forceful than those of the chest giving rise to the so-called *abdominal type of breathing*. This difference, however, is thought to be due to mode of dress and habit rather than to anatomical effects, because in uncivilized races men and women breathe in the same manner. Within ordinary limits as much oxygen can be obtained by frequent shallow breathing as by that which is deep and less frequent, but the former is thought not to be as good for the lungs.

When there is any obstruction to breathing or deficiency in the supply of oxygen, thoracic breathing predominates in both men and women, for the capacity of the chest is increased to a greater extent in this way than by contraction of the diaphragm, and all the muscles which can further the intake of air and elevate the ribs are brought into action during inspiration, and there is also likely to be more or less expiratory effort.

The respiratory interchange of gases in the lungs (*external respiration*) and tissues (*internal respiration*) like breathing, is governed by different factors, two of the most influential of which are: (1) The natural tendency of gases to diffuse or spread through space until their pressure is equal in all parts. A gas entering a cavity will follow the tendency, even when there is a partition dividing the cavity, providing, of course, that this is permeable to gases, as are the walls of the alveoli and capillaries. Therefore, as there is always more CO_2 and less oxygen in the blood of the

pulmonary capillaries than there is in the alveoli, and more oxygen in the latter than the former, the two gases pass in the opposite direction and, in the interior of the body, the oxygen pressure being greater in the blood than the tissues and the CO° pressure greater in the tissues, where it is being constantly formed, than in blood, there is a diffusion of CO_2 into the blood and of oxygen from the blood into the tissues. (2) The other particularly important factor in the transportation of the oxygen from the lungs into the tissues is that oxygen and hemoglobin have a certain amount of attraction for each other, and when the oxygen passes into the blood it enters into a weak chemical combination with the hemoglobin which is stable only in the presence of a certain concentration of free oxygen and thus, as the blood passes into the tissues where there is no free oxygen, it breaks from its combination with the hemoglobin.

The average normal relative pressure[1] of oxygen and carbon dioxid in the different parts is shown in the following table:

	Oxygen	Carbon Dioxid
Alveoli of the lungs	100.0 mms.	35.0 to 40.0 mms.
Venous blood	37.6 "	42.6 "
Arterial blood	100.0 "	35.0 "
Tissues	0. "	50.0 to 70.0 "

When aëration of the blood is defective in the lungs two changes occur in the arterial blood, viz.: there is an increase in its carbon dioxid content and a decrease in its oxygen supply. As the result of the lack of oxygen, the patient will become cyanosed, because

[1] The amount of pressure required to raise a column of mercury, or other standard, the number of mms. designated.

blood which has not enough oxygen has a dark purple tint, due to the fact that the hemoglobin, which gives normal arterial blood its red hue, is red only when in combination with oxygen.

Points other than frequency to note when counting the breathing are the depth of the movements (this has been already discussed); whether or no all parts of the chest expand equally (in pneumonia, for example, when the consolidation is on one side, the chest will expand less on that side than the other); if the breathing is quiet or forced and, in the latter case, if any particular muscles are brought into play more than others; if pain is associated with the breathing; if any of the abnormal modifications or conditions described in the following paragraphs are present.

Dyspnea, by which is meant difficult or labored breathing, may or may not be associated with changes in the rate of breathing. It is brought about by conditions, either external or internal, that interfere with the required amount of oxygen being taken into the blood and carried to the tissues. As its cause is the same as cyanoses it is usually associated with that condition. When dyspnea is so severe that the patient is unable to breathe in a recumbent position the condition is known as *orthopnea*.

Cheyne-Stokes breathing[1] is seen most frequently in patients suffering with kidney and heart diseases, arteriosclerosis, meningitis, coma, and following injury to the brain. It is a more serious symptom in the three conditions mentioned last. It has been noted also in perfectly healthy children during profound sleep. It appears in two forms. In one, the

[1] So called from the two physicians who first drew attention to this form of breathing.

respirations gradually increase in force and frequency up to a certain point and then as gradually decrease until they entirely cease, a short pause ensuing before they begin again. In the other, likewise, the respirations gradually increase in force and frequency, but they cease suddenly instead of decreasing gradually. This phenomenon may continue for some time. The causes of Cheyne-Stokes respiration are as yet imperfectly understood.

Edematous breathing must be noted the minute it begins, for it is not only a serious symptom, but an exceedingly dangerous condition. It is brought about by infiltration of serum from the lung capillaries into the air sacs and anything which will seriously interfere with the circulation of the blood in the lungs may bring about the condition. It is recognized by characteristic, loud, moist, rattling râles caused by the air passing through the fluid in the air sacs. It is always associated with dyspnea and cyanosis.

Stertorous breathing is not necessarily connected with a serious condition; it is due to a relaxed condition of the soft palate and is characterized by a deep, snoring sound in connection with each inspiration. It is nearly always present in apoplexy and in this condition the cheeks puff out with each breath.

Requisites for demonstration: The same as for counting the pulse.

Point to remember: The method and frequency of breathing can be to some extent, at least for a short time, controlled by the patient and sometimes, even without intention, this will be done when the individual knows that her breathing is being counted; therefore, do it, if possible, without the patient's knowledge. A good way of doing so is to count the

breathing either before or after the pulse and to pretend to be counting the latter while you are counting the breathing movements.

Procedure: Place your fingers as when counting the pulse, hold your watch where you can see its second hand and the patient's chest at the same time. Count an inspiration and expiration as one breath. Count for one minute.

Demonstration 39

Charting

Requisites for each pupil:

1. A blank clinical chart and a record sheet.
2. A small blotter.
3. Two penholders with fine pen points.
4. Black and red ink and other colors if necessary.
5. Sample charts, records, history sheets, and any other forms used in this connection in the hospital.
6. A sample of a clinical chart is shown in Fig. 22. Charts such as this give a much more comprehensive view of the course of the temperature, etc., than can be shown by figures or words.

Procedure: After the use of the various records and charts have been explained and samples investigated by the pupils, each pupil should copy a chart and at least one page of a record. Those who cannot print should practice at every opportunity until they can do so quickly and neatly. It is now an almost universal custom in hospitals to require the use of printed, rather than written, type of letters for they are more legible and even people who cannot write legibly will, with a little practice, acquire the

knack of making small square letters such as the following:

a b c d e f g h i j k l m n o p q r s t u v w x y z

When recording the temperature, etc., make the dot or, for a rectal temperature, a circle at the desired point and then, using the ruler if necessary, draw a line between it and the preceding point.

Points regarding records that should be remembered. The purposes of charts and records are: (1) To let the physician know what the patient's condition has been in his absence and provide him with the means of comparing the patient's condition from day to day and the effects of different medications or treatments. (2) To provide a record that can be kept indefinitely, to be used if wanted for statistics and similar purposes or in case of law suits. These purposes explain the reasons for many of the other points here mentioned.

Records must be neat, with no erasures.

The printing or writing must be legible, but the lettering should be as small as is consistent with legibility.[1]

Statements are to be brief; no unnecessary words being used, it is, for example quite unnecessary (though often done) to begin each, or even any, remark with "The patient."

Statements must be free from all ambiguity.

Each observation should be recorded in a separate paragraph.

Statements must be accurate and unless things have been actually weighed or measured definite

[1] As records are kept indefinitely it is important that they should occupy as little space as possible.

weights, etc., should not be stated, but the amount should be recorded as being about or approximately so many c.c. or gms., etc.

Record all symptoms both objective and subjective. (See Chapter XVIII.)

Record all medication and other treatments and the time at which they are given. If employed to relieve any condition that should be ameliorated in a short time (*e. g.*, headache, sleeplessness, pain, tympanites), record the result and state as nearly as possible how much time elapsed before the drug, etc., was effectual. If the treatment is such that its effects will only show after continued use—*e. g.*, a tonic—watch for results and make a daily statement of the change in the condition that is being treated.

When recording treatments, such as hot baths, that may have a bad effect, state something of the patient's condition during the treatment.

When recording the results of irrigations, douches, and the like, state whether or no the return flow was clear or contained foreign matter and the nature of the latter.

When recording the dressing of an open wound make a note of the presence or absence of discharge and the nature of the latter and general condition of the wound. Always ask whoever dresses the wound what report you are to make.

If a patient vomits record the approximate amount of vomitus, its color, and if it has any of the other characteristics mentioned under the section on emesis in Chapter XVIII.

Observe and record with special care the nature of the excreta or of discharge from diseased parts; *e. g.*, the sputum, when the trouble is in some part

of the respiratory track; the feces, when it is the stomach and intestines that are diseased; the urine, when some part of the urinary system or metabolism are at fault.

When it is necessary to measure the urine it is generally required to also measure and record the amount of liquid given.

The urine is generally measured and the result and the time the urine was voided recorded in all the following circumstances. If the patient has any disease of the urinary organs or of the heart or blood-vessels, or any disturbance of metabolism; when there is any suspicion that the patient is not excreting enough urine or if she has to be catheterized; if the urine develops any abnormal appearance; whenever the patient is very ill, or has even a mild attack of any disease, as scarlet fever, that is likely to lead to kidney complications; for the first twenty-four hours after operation and longer if any of the complications already mentioned develop.

Catamenia should be recorded and note made of any distress if such is caused.

CHAPTER VI

Baths and Packs Used for Therapeutic Purposes

The effects of cold, hot, and tepid applications, and of electric light, and of sunlight upon the body. Methods of giving: Cold and hot baths and packs, electric light baths, sun baths, salt baths, and medicated baths.

Treatments for the alleviation of diseased conditions in which water is the principal medium, as baths, packs, sprays, douches or irrigations are classed under hydrotherapy or hydrotherapeutics, which terms are derived from two Greek words meaning *water treatment*. As a matter of fact, baths and packs and, to some extent, the other treatments mentioned are used to obtain the effects of cold or heat upon the body, and the water is used merely as a convenient medium for surrounding the body or a part of it with the desired temperature.

Cold Applications

The physical properties of water by virtue of which it will cool a surface are: (1) Its power of readily absorbing heat; (2) the ease with which it is evaporated. With cold tub baths and those packs in which the wet sheet is covered by a dry blanket, it is chiefly the absorption of heat that is depended upon for cooling effects; while with sponge baths, it is princi-

pally evaporation and with the variety of packs in which the wet cover is exposed to the air both absorption and evaporation are utilized.

The reason that evaporation will cool a surface is that it requires 536 small calories to change one gram of water from a liquid to a vapor and the necessary heat is taken from whatever the water is in contact with. The more rapidly evaporation takes place, the quicker the heat is abstracted. For this reason, when giving a sponge bath, if strong effects of cold are desired, means are taken to hasten evaporation and vice versa.

The means generally used to hasten evaporation for such purpose are: (1) To expose the body; (2) to fan it (fanning hastens evaporation because it drives away the air containing the evaporated molecules of water and, the smaller the amount of moisture in the air, the greater the speed of evaporation); (3) to substitute alcohol (30–50 per cent.) for water, because alcohol evaporates more rapidly than water.

The Effect of Cold upon the System

In order to get good results from the use of cold applications in the treatment of disease, it is very essential to understand something of the action of cold upon the body and to realize that it is the effects of the body's reaction to cold that are of value for even those results which are not classed with the actual reaction effects will not take place as desired unless proper reaction occurs; because cold, except for its power of arousing nerve-stimuli, is a protoplasmic depressant.

By reaction is meant *action in a contrary direction*

to that in which advance has already been made. One of the characteristics of living matter, that is essential for the maintenance of life, is its power to respond or react to conditions that could cause destruction of protoplasm in such a way that their bad effect is overcome, and, as in the case of the reaction to cold, the conditions produced by the reaction are often of great therapeutic value.

Reaction is brought about chiefly through stimulation of the nervous system. For example, when cold is the stimulus, the nerve endings known as *cold-spots* that are in the skin are stimulated, and, as the result, afferent impulses[1] go to centers[1] in the brain and cord from certain ones of which efferent impulses[1] are transmitted to the muscles and blood-vessels.[2] As the result of these impulses a large proportion of the blood is driven from the exterior to the interior of the body and, if the cold is intense, muscular contraction will be so great that shivering occurs. As the blood is driven from the skin, loss of heat is lessened and the extra blood in the interior and the increased muscular contraction promote oxidation and consequent increased heat production. Both of these results, it can be easily appreciated, are exactly the opposite of those desired in fever, but, normally, the increase in the temperature of the blood stimulates the heat regulating centers and impulses pass from these to centers which control the caliber of the skin blood-vessels and the contraction of

[1] If these terms are not understood, read the sections on the transmission of nerve impulses and reflex action in your text-book of Anatomy and Physiology.

[2] The nerve reactions associated with these processes are far more numerous and complicated than here described.

muscles and to sweat centers. In consequence of these impulses, and probably others arising from the action of the cold, more blood is forced to the surface of the body, perspiration is increased and excessive contraction of the muscles checked. The extra blood in the skin and increased perspiration favor loss of body heat (the reasons for this were given in Chapter V), and the temperature, when it is abnormally high, may be reduced several degrees and remain comparatively low for hours. When the temperature is normal, however, there is normally never more than a very slight and temporary reduction because of the adjusting power of the heat regulating center. This was discussed in Chapter V. If, however, a good reaction does not occur, shivering will continue and the temperature may rise.

In addition to these direct reaction effects, the impulses sent out from stimulated nerve centers cause contraction of the visceral muscle, including that of the small internal blood-vessels, and thus blood pressure is raised and the heart action strengthened and, eventually, slowed. As natural results, the circulation is improved and also the functioning of all the organs; congestion of the internal organs is lessened; the nutrition of the skin is promoted and thus, any tendency to pressure-sore formation diminished.

As the result of the improvement in the circulation, the number of red-cells and leucocytes in the circulating blood is increased, due, not to any acceleration in their formation, but to their being forced into the blood-current from the large internal vessels and other parts where the sluggishness of the blood-flow has allowed them to remain. The increase of

leucocytes in the circulation will, in the infectious diseases, tend to accelerate phagocytosis.

The stimulation of the nervous system also improves the mental condition. This is seen, for example, in typhoid fever by the lessening of the lethargy which follows a cold bath and the comparative ease with which the patient can be aroused and persuaded to take nourishment; also, improvement will be noted when reverse conditions exist and the patient is restless and excited, for a quiet sleep will often follow a bath or pack.

There are several other factors besides those mentioned here, especially the effects of cold upon protoplasm, responsible for the good and bad results that can follow the use of cold applications to the body, but they are not well understood and space will not permit of giving further details.

Cold, if excessive, or if exposure to it is too long maintained, will, like other agents that act as nerve stimulants, overwhelm the centers and produce harmful effects and these, together with the depressing action of cold upon protoplasm, will cause shock and even death. On the other hand, if applications are not of a sufficiently low temperature they will produce little or no stimulation.

The degree of cold that it will be best to use[1] for therapeutic purposes will depend upon several factors:

1. The condition of the individual, for a temperature (about 80–85) that would be a strong stimulant to an old or debilitated person, or an infant, or when

[1] Bath temperatures are prescribed by the physician, but, nevertheless, nurses should understand the conditions upon which the regulation of temperature is based.

other conditions that interfere with reaction exist, would have little or no effect upon a robust man.

2. The patient's temperature, because water at 90° F. will not feel cold or arouse stimuli if the temperature of the skin is 98° F., but it will if the body temperature is, for example, 105° F. Frequently, however, when there is hyperpyrexia, other conditions may be such that a bath of particularly low temperature will be needed.

3. The parts of the body to which the applications are made. Certain parts of the body are much more sensitive to cold than others, thus water of a low temperature will not feel as cold to the face and hands as to other parts, but the feet are particularly sensitive and, when they are cold, it is harder for a person to endure and to react to cold. On the contrary, if the feet are kept warm, reaction is favored and colder water can be used on other parts of the body than might be advisable if the feet also were chilled. Naturally, applications to limited areas can be of a lower temperature than those surrounding the entire body.

4. The amount of water used and the method of its application. For examples, when conditions exist that are inimical to prompt reaction a patient may not be able to stand a tub bath at as low a temperature as a sponge bath and, a spray bath can generally be borne colder than either a tub bath or a sponge bath, for one reason, the impact of the water upon the skin, especially when it is thrown with force, stimulates other nerve endings than those excited by cold and thus a larger number of impulses pass, but over different roads and to different centers in the brain and cord, and this extra stimulation favors

a prompt reaction which, with the associated influx of blood to the skin, tends to produce a sensation of warmth and increases reaction.

The degree of stimulus that will be evoked by a treatment will depend chiefly upon:

1. The temperature of the water; the lower the temperature, the more intense the primary stimulation.
2. The amount of body exposed to the cold at a time.
3. The method of treatment; a tub bath and a spray bath will usually produce stronger stimulation than a sponge bath because more nerve endings are suddenly and simultaneously stimulated.

The degree of stimulation that will be most beneficial will depend upon the patient's condition and ability to react to cold. As previously mentioned a certain amount of stimulation is essential for results, but too much may be harmful. This being the case, in order to enable the doctor to regulate the treatment, a definite record should be made of the patient's condition during and after each bath.

Conditions which tend to retard reaction to cold are:

1. Lowered vitality—as in old age, protracted illness, debility from any cause.
2. Extreme youth.
3. Obesity, on account of the relatively poor blood-supply of the skin characteristic of this condition.
4. Low temperature of the skin. When the heart action is weak, the skin may be cold, even when the body temperature is dangerously high.
5. Extreme nervous irritability.
6. Nerve-fag. The debilitated condition of nerve centers interferes with the prompt response that is necessary for a good reaction.

7. Aversion or unaccustomedness to cold baths.

When these conditions exist measures to induce reaction must be used or, otherwise, bad effects from the treatment will result.

Symptoms which show that the treatment is having a bad effect are: Intense shivering, increasing cyanosis and pulse rate.

It is not, usually, an adverse symptom if the pulse is apparently weak at the beginning of the bath for this is generally due to the preliminary contraction of the superficial arteries, and not to any real weakness of the pulsation. Neither does a lack of reduction in temperature indicate that the bath has not had a beneficial effect, if other signs of improvement are present; *i. e.*, if the pulse is stronger, the patient brighter, and restlessness has been overcome, for, especially in the early stages of the toxic diseases, while the system is still overwhelmed with the toxins, there may be little or no reduction of temperature.

Conditions and treatments which favor prompt reaction to cold are:

1. Warm surroundings—do not give a cold bath in a cold room, especially to a patient who is not likely to react promptly.

2. Warming the skin before administering the cold treatment. This is usually accomplished by giving friction or by sponging the body with hot water.

3. Sudden application of the cold[1]—even when a

[1] If a frog whose brain has been destroyed, but spinal cord left intact so that the reflex centers are unimpaired, is put into a basin of cold water, it will at once jump out; but if the water is tepid when the frog is put in and cooled gradually, the frog will not move.

preliminary hot bath is given the change from heat to cold is not to be gradual.

4. Keeping the feet warm during the bath.

5. Friction during and after the bath—this warms the skin.[1]

6. Wrapping the patient in blankets and giving a hot drink after the bath.

How many and which of these procedures should be used will depend upon the existence or absence of conditions favorable for reaction. As a rule, a sick person needs and must be given friction during a cold pack or bath because she is unable to make the brisk movements that a healthy individual naturally resorts to. Also, a patient confined to bed is wrapped in a blanket after the completion of the cold treatment, but the time that the cover is to be left in place and whether, and how long, friction is to be continued will depend entirely upon the patient's condition. If she is shivering, they are needed, but, as soon as shivering ceases, this part of the treatment is to be discontinued. A patient who does not react readily is generally given friction before, and a drink of hot broth after, the bath, and the doctor generally requires the temperature of the first few baths (until the patient becomes accustomed to the treatment) to be relatively high (85°–90° F.) and gradually reduced, about two degrees daily, until the desired point is reached. What this will be depends, as already stated, upon the patient's age, condition, and habits.

[1] Friction is given in connection with baths by passing the hand rapidly back and forth over the skin, treating limited areas at a time; the fingers and wrist must be held loosely and, when the baths are given several times a day, the pressure must be light, for heavy friction, if given repeatedly, will make the skin and muscles sore.

To repeat: Reaction is necessary for good results, in fact, it is essential to prevent adverse results, and to get reaction the degree of stimulation, and the number of aids to further reaction, must be sufficient, but not excessive.

Cold, preferably in the form of a moderately full ice-cap, is kept on the head during a cold treatment that is continued for more than a few minutes, because, unless the cerebral vessels are contracted, there is likely to be an undesirable influx of blood to the brain when the superficial vessels become contracted. This is especially necessary when the patient is confined to bed and unable to make the vigorous movements (as a healthy individual does) which bring the blood quickly to the limbs.

When the patient has a high temperature, the ice-cap is usually left on after the bath.

Demonstration 40

The Brandt Bath

The use of the cold tub bath in the treatment of fever was introduced into Germany by Dr. Brandt in 1861, but, in this country, it did not come into general use until 1890. After that date it was very extensively used for some years, especially in typhoid fever; of late, however, cold sponge and spray baths and cold packs have, to a great extent, taken its place for these can be given on the bed or on a table the same height as the bed, to which the patient can be easily drawn, and there is considerable danger of causing hemorrhage or perforation when lifting the patient into and out of the tub. With some patients, however, the sponge or spray will not

afford sufficient stimulus and the tub bath is then resorted to.

Equipment: 1. A portable bath tub about half full of water at the required temperature. The doctor orders the temperature; it is usually about 75° F., but a lower degree (70°–68° F.) is often prescribed for patients of good physique.

2. A stretcher—those in common use are made of strips of strong webbing, about one inch in width, so latticed as to form squares with open spaces of about two inches between each strip. It is surrounded and attached to a double strip of canvas, so arranged that poles can be run through it.

3. A rubber ring or air pillow to put under the patient's head.

4. Non-absorbent cotton to put in the ears, to prevent their becoming filled with water.

5. A bath thermometer

6. A basin containing two or three moderate-sized pieces of ice, which are used to lower the temperature of the water if it becomes raised during the bath.

7. An ice-cap or, instead, two wet gauze compresses for the head. These are cooled on the ice, one being kept on it while the other is on the patient's forehead. They should be changed every two minutes.

8. A binder to put around the patient's loins.

9. Safety pins and, if the patient is a woman, hairpins.

10. A rubber sheet to protect the bed.

11. Two cotton sheets.

12. Two towels.

13. A hot-water bag and cover.

14. A bath blanket.

Procedure: Arrange your equipment and make sure that the temperature of the water is correct.

Pin the binder around the patient's loins.

Put some cotton in her ears.

Pin her hair up so that it will not get wet.

Remove the nightgown.

Put your watch or a clock where you will be able to see it well during the bath.

Substitute the bedclothes for the bath blanket in the usual manner.

Put the stretcher (without the poles) under the patient in the same manner as you would a sheet. Put the rubber ring under her head.

Insert the poles through the folds provided for them.

With the help of an assistant, lift the stretcher, with the patient on it, to one side of the bed.

Draw the tub to the same side. Leave room enough at the top to stand while you move the stretcher.

Turn back the bath blanket.

Take hold of the poles of the stretcher at one end, have your assistant do likewise at the other, and lower the patient into the tub; rest the poles on the hooks of the tub intended for them.

Put the ice-cap or cold compresses on the head and then begin to give friction at once and have your assistant do likewise.

After the legs have been well rubbed, the nurse doing this part of the body can stop and arrange the bed. Once a day, the mattress should be turned and the bed entirely remade; but, during other baths, it is usually only necessary to tighten the rubber and draw-sheet and fold the upper covers neatly at the foot of the bed. Fold the bath blanket and hang it across a bar of the bed or over the back of a chair,

put the pillow in place. Cover the bed, including the pillow, with a rubber sheet and over this, on the half farthest from the bath, place half of a muslin sheet; let the other side hang free but tuck a little of it loosely under the mattress in one or two places, so that the sheet will remain in place (this side is put over the patient after she is removed from the tub). Place a covered hot-water bag at the foot of the bed under the folded covers.

Arrange the bed as quickly as possible and then begin to rub the patient again.

The nurse giving friction to the upper part of the body must rub the back particularly well. When a patient has typhoid, the abdomen is not to be rubbed.

When giving a bath to a sick patient watch her condition carefully and feel the pulse every two or three minutes. As previously stated, the pulse may appear weaker for a time, on account of the contraction of the superficial arteries, and it may be more rapid, as the result of the sudden stimulus to the nervous system, but it, usually, soon becomes slower; should it become more rapid and the patient cyanosed she should be removed from the bath and the doctor notified.

Except in emergency, before removing the patient from the bath, to prevent exposure, stretch a sheet lengthwise, rather loosely, across both bed and tub; tuck one end under the mattress,[1] pin the other to the stretcher hooks.

Unpin the binder; leave it in the tub for the present.

Raise the stretcher and hold it for a few seconds

[1] The portion of sheet that is hanging at the side of the bed need not interfere with your doing this, for it can be gathered up loosely between this sheet and the mattress.

above the tub to drain off the water. Then place it on the side of the bed nearest the tub.

Unpin the sheet that is fastened to the stretcher hooks and move the tub out of the way.

Take out the stretcher poles.

You and your assistant go to the other side of the bed and draw the patient over on to the sheet that is covering the rubber on that side. Turn the free end of this sheet over the patient, under the one that was used to prevent exposure during lifting. Remove the latter.

Dry the patient by rubbing over the sheet with which she is enveloped and with a towel. Remove the cotton from her ears.

Cover her with the bath blanket and turn down the part of the sheet covering her.

Go to the other side of the bed, roll the rubber to the patient's side, and then, with your assistant's help, draw her to the center of the bed.

Turn her slightly while you remove the rubber and sheet, and if she is shivering slip a part of the blanket under her back.

Wrap the blanket loosely around her feet and legs; put the hot-water bag near her feet and the ice-cap near her head.

Draw up the covers and, if the patient is shivering, under the bed clothes, but over the blanket, give friction while your assistant gets her some hot broth.

Remove your equipment and disinfect it according to the hospital rules if the patient has an infectious disease.

Remove the blanket when the patient ceases to shiver or feel very cold and put on the nightgown.

Take the temperature one half hour after the bath.

In addition to their use in fevers, **cold tub baths are used also as nerve and circulatory stimulants in neurasthenia and general debility,** and to, by accustoming the system to react to cold, overcome abnormal tendency to "colds." When they are used for these purposes, the patient is, as a rule, not confined to bed. In such case, the nurse's most important duty will be to see that conditions which will assist reaction are present, especially, that (1) the bathroom is warm and (2) the patient warm when she enters the bath. Also, when the patient is not accustomed to taking cold baths and dislikes them, or other conditions unfavorable to prompt reaction exist, it is well to provide a warmed bath blanket or bathrobe or sheet in which to envelop her the moment she steps from the bath and to dry her quickly, with a warmed towel, under this wrap.

When the bath is given without friction, the patient usually only remains in it two or three minutes; in fact, for the first few baths the duration prescribed may be half a minute, and, especially for an elderly person or one who for other reason has high blood pressure, the temperature prescribed for the first few baths is comparatively high (about 80° F.), for it can easily be appreciated that as cold baths increase blood pressure, they might be dangerous in such a condition unless the system was accustomed to them.

Sometimes, when a full cold bath is thought to be too strenuous a treatment, a partial bath is prescribed; for example, bathing the face and chest with cold water or, when the circulation in the lower limbs is poor, as evidenced by the feet being constantly cold, plunging the feet and legs into cold water and dash-

ing the water over the thighs while the upper part of the body is kept warm.

Demonstration 41

Cold Sponge Baths

Method 1. Equipment: 1. A heavy double-faced rubber sheet, that is in *perfect condition.*

2. A strip of bath blanket or of muslin or a bath towel.[1]

3. Two towels.

4. A loin binder and, for a male patient, safety pins.

5. A large washcloth, preferably of Turkish toweling about eighteen inches square.

6. Two hot-water bags and one cover. One hot-water bag is left uncovered and the water in it is not to exceed 120° F.

7. A foot-tub or large basin half full of water the required temperature, usually between 70° and 80° F.

8. A bath thermometer.

9. A basin containing one or two rather small pieces of ice; this is to lower the temperature of the water if necessary and, if compresses are used, to keep them cold.

10. An ice-cap with cover or else two wet gauze compresses.

[1] This can be omitted if the patient is in stupor; it is only used because patients who are conscious are likely to object to lying on the rubber, but its presence makes it much harder to remove the rubber after the bath without wetting the bed. It is because of the difficulty of doing this that a narrow strip of material is better than a sheet. A hemmed strip (about two feet by five) prepared from an old cotton bath blanket is excellent for the purpose.

11. A bath blanket.

The demonstration doll, if covered with waterproof material, can be used as subject for the baths and packs, but the pupils are strongly advised to, when practicing, take turns "being patients."

Procedure: Replace the top covers with a bath blanket in the usual manner (see page 63); leave the covers folded at the foot of the bed.

Cover the bedding, including the pillow, and the covers that have been folded across the foot of the bed, with a rubber sheet. This is usually best done as follows: Draw the patient to one side of the bed, cover the other half with the rubber, placing the part which is to cover the portion of bed on which the patient is lying folded against and, as far as possible, under her side.

Cover the part of the rubber on which the patient is to lie during the bath with the strip of bath blanket[1]; put one edge of this under the folds of rubber so that it will not be pulled out of place when the patient is moved.

Move the patient to the center of the bed and finish arranging the rubber.

Remove the nightgown.

If the patient is a man, have the orderly pin a binder around his loins, if a woman, cover the pubic region with the binder, leaving the latter longer on one side than the other so that it will fall behind the patient when she is turned.

Place the ice-cap on the patient's head, and the uncovered hot-water bag near her feet and the covered one under the covers at the foot of the bed.

[1] Same as preceding page.

Put the bath thermometer in the water and note its registration.

Remove the bath blanket and hang it over a bar of the bed or, if the patient is not likely to react easily, expose the chest but leave the blanket covering the legs until you are ready to bathe them. This can be done also for the first bath or two, until the patient becomes accustomed to the treatment, if she objects to being exposed, but, if the temperature is high, it is usually desirable to expose the body during the bath in order to hasten evaporation.

Place your watch where you can see it easily.

Count the patient's pulse and note its character.

Give light friction for about two minutes and then begin sponging.

Hold the wash-cloth bunched so that there will be no wet tails.

Have plenty of water in it and squeeze this over the body as you wash; use, for the most part, a downward, sweeping stroke, especially if there is body hair. A common error in giving such baths is to take an upward stroke with the idea that this helps the circulation; in reality, the pressure as usually made with the sponge is not deep enough to effect venous circulation and, as it rubs against the hair, it often produces irritation of the skin. The hand, when giving friction, is moved quickly and lightly backward and forward, making short strokes, but if the wrist and fingers are held loosely, the effect of the upward stroke is quite different from that of the pressure produced by the wash-cloth. When possible, have an assistant to help with the bath as friction can then be given continuously. If, however, you cannot get help sponge with one hand and rub with the other,

and periodically stop the sponging and give friction over the entire body for a minute. Wet the sponge frequenty in the cold water and mop that in the rubber up with it from time to time; squeeze the latter from the cloth into the basin and, as this will soon raise the temperature of the water in the basin, watch the thermometer and, when necessary, put in a small lump of ice until the temperature is reduced (do not let the patient see you doing this, in fact it is well not to let her see the ice at all). While giving the bath, keep the patient's arms away from her sides and sponge the axillæ frequently. The doctor states the length of time that he wishes the bath continued. This is usually between ten and twenty minutes. After about two thirds of the time has passed, turn the patient toward you and support her with one hand while you sponge her back for the remainder of the time, but, unless you have an assistant, it will be necessary, if the patient is shivering, to rub the legs periodically for a few seconds.

With the patient still turned, mop the water from the rubber.

Dry the patient's back and uppermost shoulder and then, as well as possible, the rubber behind her. Roll that side of the rubber up to her back, spread one side of the bath blanket over the uncovered portion of the bed, and turn the patient onto this and exchange the binder for a towel.

Remove the uncovered hot-water bag.

Wipe the other side of the rubber, roll it toward the center; turn the top and the bottom toward the center, and, holding it carefully, so as not to spill any water that may have been left on it, remove it

from the bed and place it in the basin. The reason for folding the rubber in this way is that, if there is any water remaining, it will be in the center and, unless the rubber is folded, the water is likely to be spilled on the bed or floor.

If you have an assistant, let her dry the patient while you are attending to the rubber. If you are alone, get the rubber out of the way as quickly as possible, dry the patient, and, as you pull the free end of the blanket over her, remove the towel which you used to replace the binder.

Put the hot-water bag at her feet and the ice-cap on her head.

Draw up the covers.

The after-treatment is the same as that following the tub bath.

During the bath, watch the patient's pulse and general condition constantly. This is to be remembered when giving any kind of bath or pack in the treatment of disease and, naturally, the worse the patient's condition, the greater the necessity for watchfulness.

Method 2. The main difference between this method and Method 1 is that the rubber sheet[1] is raised along the sides and at the foot and thus water can be used more freely when giving the bath.

Equipment: The same as for Method 1 plus an empty pail and two large, old blankets, both of which should be rolled and, if necessary to keep them so, pinned or tied with string, or, instead of the blankets, heavy twine and four clothespins.

[1] Unless this sheet is of heavy rubber, two had better be used, one under the other. When two are used they are placed together and put under the patient at the same time.

Procedure: Same as Method 1 with the following exceptions:

After the rubber sheet is in place, put a rolled blanket under it on each side, or else tie a piece of heavy twine on each side to bars at the head and foot of the bed, at the desired height, and secure the sides of the rubber over the cord with clothespins.

After you have removed the bath blanket, fold, and place it under the rubber at the foot.

Squeeze the water over the patient from the washcloth, until there is a considerable amount around her. Then scoop the water up with the hand and rub it over the patient; do this alternately with friction and from time to time mop the water up with the cloth and squeeze it into the empty pail and put fresh water over the patient. If the water in this pail is to be used again, cool it with ice, to the required temperature.

As there will be so much water in the "bath" it will be better to turn the patient slightly two or three times and rub her back, rather than keeping her turned for a longer period at one time.

As in Method 1, it is well to have an assistant, if possible, especially if the patient is not likely to react readily, for the friction can then be continuous and this helps very considerably in controlling shivering.

Demonstration 42

Spray Bath

This is frequently used instead of the sponge bath because the percussion effect of the spray upon the skin helps in getting a speedy reaction.

Equipment: Same as for the sponge bath (Method 2) with the following exceptions and additions:

The rubber sheet must be long enough to extend from the top of the pillows to about four inches[1] into a pail placed at the foot of the bed.

The water for the bath should be in a four-gallon irrigator or pail, instead of a basin or tub, and this is to be stood on a stand that is between twelve and eighteen inches higher than the bed.

If an irrigator is used two empty pails will be required, otherwise, one will be enough.

A rubber, about a yard square, to put on the floor under the pail that is to catch the water from the bath.

A bath spray with, if an irrigator is not used, a funnel inserted in the open end.

A small pitcher containing water the same temperature as the bath. This is used when starting siphonage and will not be needed if an irrigator with an opening at the base is used.

Blocks or other appliance for raising the head of the bed about two inches.

Procedure: This is about the same as for the baths previously described, but the water is sprayed over the body and more is allowed to accumulate in the rubber and, instead of mopping it up, when enough has collected, it is allowed to run slowly into the pail placed at the foot of the bed, the washcloth being used only to dry the rubber before removing it. To facilitate drainage the head of the bed is raised

[1] If the rubber extends too far into the pail it will be in the way, if it is too short it may be pulled out of the pail during the bath. If a long rubber cannot be obtained, two can be used and the upper edge of the lower one inserted about twelve inches under the upper one.

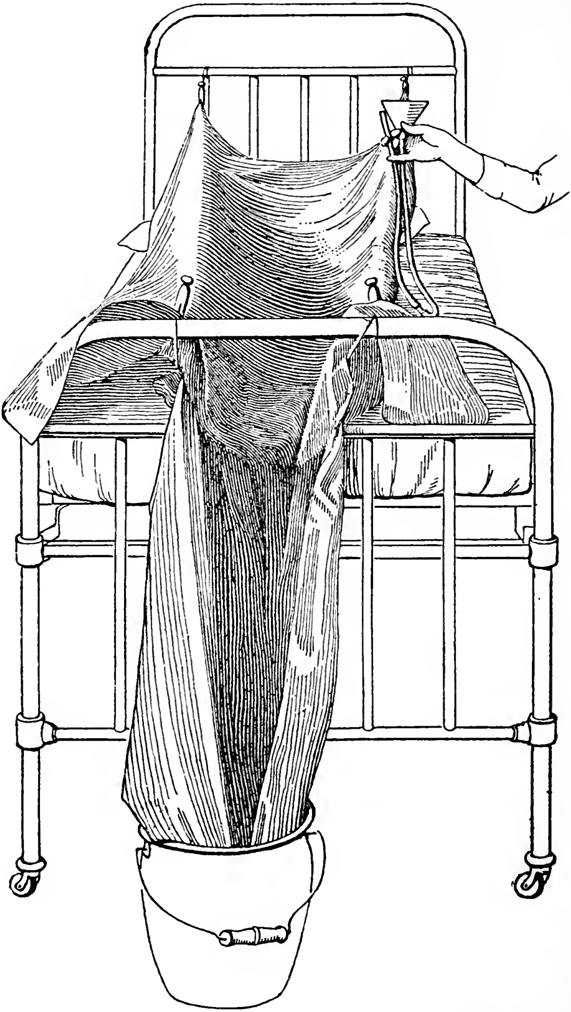

Fig. 23. Rubber Sheet arranged for Spray Bath. Method of Holding Funnel and Tubing while Filling them for Siphonage.

slightly, about two inches, and, to prevent drainage until it is required, the sides of the rubber of the improvised tub are brought near together at the feet and the hot-water bag is placed in the opening. The blanket is not put under the rubber at the foot of the bed.

While giving the bath, hold the spray in one hand and move it back and forth above the body while, with the other hand, you give friction and from time to time scoop up some of the water that is in the bath and rub it over the patient. Turn the patient very slightly, every once in a while, alternating the sides, and rub her back.

After about half of the water has run from the reservoir, open the sluice at the foot sufficiently for the water to run slowly from the bath and, if it is necessary to re-use that water, put a small piece of ice in the pail and leave it until the temperature of the water is reduced to the desired degree. If possible have an assistant to do these things, for the friction ought not to be interrupted.

To remove the bath, drain off the water as well as possible, let down the sides and wipe the rubber. Turn the patient on her side, roll the rubber to her back and proceed as when giving a sponge bath, with the exception, after the sides of the rubber have been rolled to the center, of folding it downward and putting it into a pail. It will probably be necessary to take the pail that was used as a reservoir for this purpose.

If you have not an assistant, endeavor to do this work particularly quickly but, if the patient is shivering, stop for a few seconds occasionally and give friction over the body.

Siphonage. The only difficulty in giving this bath

is in starting siphonage, when a pail is used instead of an irrigator. However this is easy enough once one acquires the knack and this merely requires practice and an understanding of the principles involved. These are: If a tube is filled with water and one end placed in a reservoir containing water and the other end, which must be of greater length than the part in the reservoir, hangs downward the difference in the lengths of the upward and downward extensions of the tube will cause the pressure of the water in the tube to be unbalanced and this and the atmospheric pressure upon the surface of the water in the reservoir will force the water through the tube, even though it must flow at first against gravity —*i. e.*, upward.

Since the unbalanced pressure within the tube is one of the primary factors in siphonage two essentials in the procedure are: (1) The reservoir must be high enough to allow of the free end of the tube being longer than that within the pail. (2) The tube must be filled with water and means taken to keep it full until the flow is started. One way of doing this is to hold the tube as shown in Fig. 23, pour water into the funnel until the tube is filled and then, by pushing the finger that is in front of the tube backward, press the latter against the end of the stem of the funnel. And, at the same time, to pinch the other end of the tube (in which a spray should have been inserted) between fingers of the other hand, lower the funnel into the water and the spray over the body, then *release both ends simultaneously*.

Two conditions likely to interfere with siphonage during the bath are: (1) Pulling the funnel above the water; (2) allowing the tubing to become bent upon the edge of the pail.

Demonstration 43

Alcohol Baths

As alcohol evaporates more rapidly than water it cools the skin more readily and causes greater stimulation of nerve endings. Therefore, good effects can be obtained with the use of a smaller amount of alcohol than of water and, for this reason, alcohol baths are given more especially when, for any reason, it is not desirable to move the patient enough to protect the bed sufficiently to allow of the use of much water.

Method 1. This method is used when the patient is not to be turned.

Equipment: 1. Three strips of cotton blanket or three bath towels.

2. A dressing towel.

3. A dressing basin containing about one quart of alcohol, thirty per cent., of the required temperature.[1]

4. A basin containing water about ten degrees lower than the alcohol.

5. A basin containing some small pieces of ice.

6. A bath thermometer.

[1] The following schedule of bath temperatures used for different degrees of body temperature is commonly observed when the doctor does not state the degree that he requires and the patient's condition is not likely to interfere with reaction.

Mouth temperature	Rectal temperature	Bath temperature
102.5° F.	103.5° F.	90° F.
103° "	104° "	85° "
103.5° "	104.5° "	80° "
104° "	105° "	75° "
104.5° "	105.5° "	70° "
105° "	106° "	65° "

7. A covered ice-cap.
8. A fan.
9. A covered hot-water bag.
10. A bath blanket.

Procedure: Exchange the top covers for the bath blanket in the usual manner, folding the former to the foot of the bed.

Tuck a strip of bath blanket or a bath towel under the patient at each side and place another one under her legs. Place the legs so that they will not be in contact during the bath and put the arms away from the sides.

Put the ice-cap on the patient's head and the hot-water bag (covered) at her feet.

Remove the nightgown.

Fold two dressing towels and put them in the water.

Put your watch where you can easily see it during the bath.

Count the patient's pulse and note its character.

Wring out one of the towels that you put into the water and place it (folded) over the abdomen and pubic region.

Fold the bath blanket down to the foot of the bed. You can leave a portion of it over the feet and legs if conditions inimical to reaction exist.

Begin to sponge; usually, in giving alcohol baths, it is well to give each part of the body its full share of sponging at one time; *e. g.*, if twenty minutes is the time limit prescribed for the bath, sponge each part for four minutes as follows: (a) half of the chest and one side and arm; (b) the entire leg of the same side; (c) the other half of the chest, side and arm; (d) the other leg; (e) the back. To do the back, when the patient is not to be turned, raise her very slightly

on one side and sponge as much of it as you can for two minutes and then do likewise on the other side.

During the bath observe the following points:

In sponging use long, downward, sweeping strokes.

Change the towel on the abdomen every four minutes and keep the one not in use in the cold water.

Give friction if the patient shivers.

Keep constant watch of the patient's pulse and general condition; if these remain good, fan her, at the completion of the bath, until she is perfectly dry. Otherwise dry her with a towel.

After the bath is completed, draw up the bath blanket, remove the wet towels and those protecting the bed, and proceed as after the other baths.

Method 2. Equipment: The same as for Method 1 with the exception of a rubber sheet (this need not be a heavy one) and, if the patient is conscious, a strip of bath blanket or muslin, instead of the three bath towels or substitutes used to protect the bed.

Procedure: This is the same as for Method 1, except (1) put the rubber, covered if necessary, under the patient in the same manner as for the Method 1 sponge bath with water; (2) as the bed is more efficiently protected use the alcohol more liberally; (3) turn the patient well over on one side while you are sponging her back and dry it by fanning.

Demonstration 44

Cold Packs

Cold packs are, as previously stated, used for the same purposes as cold baths and, to get good effects

and prevent bad ones, the same precautionary measures must be taken when giving them.

The methods here described are the ones that are very commonly used but they are only a few of the many ways of giving cold packs.

In Methods 1 and 3 rapid evaporation is the chief action depended upon to assist the results of nerve reflexes in cooling the body though there will be some absorption of heat; in Methods 2 and 4 it is the absorption of heat by the water that is relied upon and, to get the best effects, evaporation except during the alcohol rubs is to be inhibited as far as possible.

Method 1. Equipment: 1. A foot tub or large basin half full of water the required temperature. This is specified by the doctor; it is usually between 70° and 85° F., the higher temperatures being used for those who are not likely to re-act promptly.

2. A bath thermometer.
3. A rubber sheet.
4. Three small muslin sheets.
5. An ice-cap.
6. A hot-water bag in a cover.
7. A whisk or, better, a small watering can, a child's toy watering can is the best as the holes in the sprinkler are small and, in the pack, unlike the bath, only a small amount of water is used at a time.
8. A bath blanket.
9. Two towels.
10. A binder.

Procedure: In turn, open each sheet and gather it loosely, lengthwise, and put it in the water.

Replace the top bed covers with the bath blanket in the usual manner, folding the covers to the foot of the bed.

Move the patient to the side of the bed farthest from the tub and turn her on her side.

Cover the vacant part of the bed, including the pillows and the covers at the foot with the rubber sheet, leaving the part that is to cover the remaining portion of the bed folded against the patient's side.

Fig. 24. Wringing sheet.

Wring the water out of one sheet. To do this, pass one wrist under the folds of sheet at about the middle of its length (see Fig. 24), grasp the sheet with both hands near this point and twist in opposite direction with each hand. When the water has been squeezed from this portion let it hang outside the tub and grasp and squeeze the adjacent part, repeat as often as necessary.

Spread this sheet out on the rubber putting one edge of it under the folds.

Turn the patient onto this sheet.

Put the hot-water bag at her feet, the ice-cap on her head and the binder over the pubic region.

Wring the water out of the other sheet and then, with one hand, turn the blanket down from the chest; replace it with the wet sheet.

Open out the wet sheet, turn the blanket from the lower part of the body, draw down the sheet, put it between the thighs and legs and place these apart, On each side draw a portion of one of the wet sheets around the arm.

(N. B. Every part of the surface of the body is to be in contact with a wet sheet and no two body surfaces are to touch each other at any point.)

The patient remains thus for the length of time prescribed by the doctor (this is usually fifteen or twenty minutes) and, during this time, give friction over the sheet, turning the patient from time to time to do so to the back. When the sheet gets warmed, sprinkle it, either with a watering-can, holding it a considerable distance above the patient, or by splashing water from a whisk.

To remove the pack: Take off the upper sheet, dry the patient's chest, sides, arms, and legs, tuck the bottom sheet somewhat under her (so that it will not wet the bath blanket when it is drawn up), and dry the rubber on both sides.

Pull up the bath blanket.

Roll the rubber to and, if possible, somewhat under the patient on one side.

Make sure that the patient's side is dry and then turn her over on to the bed.

Roll the rubber from against the patient's back sufficiently to get it out of your way and then wipe her back.

Then, unless you have an assistant who can do so while you are drying the patient, roll up the other side of the rubber and, with it, the sheet toward the center and fold them from the top and bottom to the center and then remove them, being careful not to let any water that may remain drip on the bed or floor. There is frequently much more water left on the rubber than might be expected.

Draw up the bed-covers. If the patient is shivering, rub her over the bath blanket and tuck this around her. Leave the hot-water bag at her feet and the ice-cap on her head.

The remainder of the treatment is the same as after the baths.

Method 2. Equipment: This is the same as for Method 1, plus a second blanket and a bottle of fifty per cent. alcohol[1] and minus the watering-can or whisk. Cover the rubber sheet with the blanket (which should be a large one) with the latter extending four inches above the rubber at the top—*i. e.*, the part that is to go under the patient's head—and roll or fold the two together before bringing them to the bedside.

Procedure: With the exception of having the blanket covering the rubber and placing these so that the rubber comes two inches and the blanket four, above the patient's neck, proceed as in Method 1 as far as, and including, covering the patient with the wet sheet and bringing the sheets around her

[1] The alcohol used must be at least 50 per cent. so that it will evaporate quickly.

arms and legs. As in Method 1, no two surfaces of the body are to be in contact and except for the head and feet, the patient is to be completely surrounded with wet sheets.

Do this work as quickly as possible so that the patient will not chill and then bring up the side of the blanket that is farthest from you over the patient; bring the upper edge obliquely across the chest so that it will fit snugly around somewhat more than one half of the front of the neck and, to secure it, make a fold in the side of the blanket (see Fig. 25) stretch it tightly and tuck it under the patient all along the side on which you are standing. Go to the other side of the bed, and treat the opposite side of the blanket in like manner. Tuck an edge of a towel between the blanket and the patient's neck.

(N. B. The blanket is to be very firmly drawn around the patient, especially at the neck and feet so as to prevent the circulation of air over the wet sheets, for this will cause rapid evaporation and favor chilling, which is to be avoided.

Draw up the bath blanket which you folded to the foot of the bed and tuck it under the patient's shoulders and sides and around her legs.

See that the hot-water bag is in place at the feet and if the patient is shivering draw up the covers, but fold them down again as soon as she ceases to do so.

Count and note the character of the patient's pulse and observe her general condition. She may feel cold and even shiver slightly for about five or ten minutes, but if, at the end of this time, she does not feel warm, the doctor should be notified.

The doctor prescribes the length of time that the

patient is to be left in the pack. This is usually thirty or sixty minutes or longer if she goes to sleep when the pack is given for sedative effects. If it is used to reduce temperature, the upper sheet is changed every ten minutes.

To remove the pack: Turn down the bed-covers, but leave the bath blanket in place; under this, fold down the sides of the other blanket; remove the wet sheet covering the patient, turn the patient on her side and rub her back with alcohol, using a liberal supply, pour the alcohol on to your hand from the bottle. Rub the back until it is dry.

Go to the other side of the bed, roll the wet sheet, blanket, and rubber together, into as small a fold as possible, up to the patient; turn her over on to the uncovered portion of the bed.

Remove the rubber, etc.

Turn the covering bath blanket down below the chest and rub the latter with alcohol. When this has evaporated, put on the nightgown.

Turn the blanket over the chest and off the legs and rub these with alcohol.

Draw up the covers and remove the bath blanket at the same time.

If the patient has fever, take her temperature half an hour after the bath, but, though this pack is used in hyperpyrexia, especially with patients who do not react readily to cold, its more common use is in the treatment of abnormal nervous conditions.

Method 3. This method is used when the patient is not to be turned and the applications are made to, except the legs and arms, the anterior surface of the body only. It is very frequently used in the treatment of surgical patients who have a high tempera-

ture. In such cases, cover the surgical dressing with oil muslin or rubber tissue that it may not become wet.

Equipment: 1. A large basin containing water the temperature that has been ordered; this is usually between 68° and 85° F., the higher temperatures being, as usual, for people who are not likely to react well.

2. Three strips of cotton blanket or bath towels.

3. Several face or dressing towels, the number depending upon their size; usually seven or eight are required.

4. A bath thermometer.

5. A basin with a few small pieces of ice.

6. An ice-cap.

7. A hot-water bag and cover.

8. A binder.

Procedure: Put the towels in the water.

Prepare the patient as for an alcohol sponge, Method 1.

Wring the towels, in turn, fairly dry and put them around the arms and over the chest and abdomen and then around the legs. Keep one in the water with which to start changing those on the body. Change them in turn, one every minute, and rub the body over the towels between times. Otherwise, continue as for Method 1 pack.

Method 4. Occasionally, a pack is ordered for the upper part of the body only, and, in such case, the following method is one that is very commonly used.

Equipment: 1. A rubber sheet that will extend from the neck to the waist.

2. A towel.

3. A nightingale or strip of bath blanket.
4. A binder of double flannelet cut to fit the chest; see Fig. 43.
5. Two compresses made of four thicknesses of soft muslin and cut to fit (a) the front and (b) the back of the chest.
6. Safety pins.
7. A basin of water the required temperature; this is usually between 65° and 80° F.

Procedure: Put the compresses in the water.

Remove the nightgown and, at the same time, cover the front of the chest with the nightingale.

Pass the rubber, covered with the binder, under the patient's back; make sure that the binder is in proper position.

Wring out one compress and pass it under the back, wring out the other and spread it over the chest, under the nightingale. Leave as much water in the compresses as possible to have without its dripping on the bed.

Pin the back and front shoulder pieces together with the ends overlapping so that air will not be able to enter and pin the fronts together; these also must overlap, but they must not be drawn tightly as it is imperative not to interfere with the breathing.

Cover the upper edge of the nightingale with the towel and tuck the former behind the shoulders.

The compresses are changed according to the doctor's orders; sometimes, the treatment is continuous and they are changed every hour; sometimes, they are changed about every fifteen minutes for from one to two hours and the treatment then discontinued for about four hours.

Hot Baths and Packs

The Action of Heat

Heat is a stimulant that is necessary for life and, when the body's vital activities are depressed, to surround it with heat is one of the first and most important requisites. But, when heat is excessive, it produces changes in tissue protoplasm that cause its destruction and, even when not intense enough to do this, it can, by interfering with heat elimination,[1] cause a rise of body temperature which will induce changes, the nature of which are not well understood, that may cause death. However, a degree of heat that would cause death if long continued, may be borne by the body for a short time, and in certain abnormal conditions which will be mentioned later, some of its effects are of great therapeutic value. For when an individual is surrounded with a medium the temperature of which is even a few degrees higher than the body, the nerve endings in the skin known as *hot-spots* are stimulated and the impulses thus initiated have several important results among which are the following:

[1] Heat, it will be remembered, is eliminated chiefly by the skin by radiation and evaporation. If the air or other medium surrounding the body has a higher temperature than the body, the loss of heat by radiation will be lessened, but, within fairly wide limits, so long as the surroundings are dry, ill effects from this will be averted because of the diaphoresis induced by the heat and the consequent increased loss by evaporation. If, however, the surroundings are moist, evaporation also will be retarded. This is one reason why Turkish (hot-air) baths can be taken at higher temperatures than Russian (vapor) baths and why heat is so much harder to stand on a humid than on a dry day.

1. Vasoconstrictor centers are first stimulated and then, especially those connected with fibers supplying the blood-vessels in the skin, depressed, and thus there is soon a very much larger amount of blood than usual in the skin vessels, for these, when relaxed, can hold one half of the entire blood supply of the body. As the amount of blood at the surface of the body is increased, there is of course less in the interior, and therefore, if there is congestion in any of the internal organs, it may be relieved. Another result of the large amount of blood in the skin is that, as it comes in contact with the hot air or water, it becomes heated and, as the heated blood flows to the interior, increase of oxidation is favored. This and the interference with heat elimination cause a rise of body temperature, which, however, if the bath or pack is not too long continued, will be only temporary, for the heated blood also induces diaphoresis and, as soon as the external heat is removed, there will be increased loss of heat due to the evaporation of sweat and extra loss by radiation as the result of the accrument of blood at the surface.

2. Centers which send impulses to the muscles and maintain muscle tone are more or less depressed and thus the muscles become relaxed. This includes the heart muscle and, consequently, the heart action is weaker and more rapid. As the result of this and of the relaxation of the blood-vessels, and of the loss of fluid from the body by diaphoresis, blood pressure is reduced.[1] This action, if not too great, when

[1] The chief direct factors influencing blood pressure are the tone of the arteries, the force of the heart beat, the volume of the blood in the vessels, and the viscosity of the blood. Increase above the normal degree in any of these things will cause high

blood pressure is abnormally high, is of great benefit, but, if it is excessive, faintness and even death may occur. Faintness is the result of cerebral anemia, which an abnormally low blood pressure very readily produces; because the flow of blood to the brain, being against gravity, is more easily interfered with than that to other parts.

3. Diaphoresis, as already mentioned, is induced as soon as the temperature of the blood is increased, chiefly, it is thought, through the intervention of the heat regulating center. As much as a quart of water has been extracted from the body during a hot pack.[2]

Important benefits that can be obtained from diaphoresis are:

(a) The lessening of edema and of dropsical effusions in the body cavities. The reason that diaphoresis promotes the absorption of fluid from the tissues and cavities is that the extraction of water from the blood by the sweat glands increases its concentration, and it will be remembered that when two liquids of different densities are separated by a permeable membrane the one of lesser density passes through the membrane (osmosis) toward the liquid of greater density much more readily than the concentrated liquid exudes.

(b) Elimination of salts and of protein waste material. When the kidneys are functioning properly, there is very little elimination of these substances through the skin, normal perspiration consisting al-

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blood-pressure, and decrease, low blood pressure, either of which conditions will interfere with the circulation and, consequently, with the well-being of the body.

[2] The individual on whom the experiment was tried was encased in a warmed rubber bag during the pack and thus it was possible to collect and measure the sweat.

most entirely of water with only about 1.8 parts of salts in a thousand of water and mere traces of protein and other organic substances. When, however, there is an excess of such substances in the blood, there may be some increase in their extraction by the sweat glands, especially if diaphoresis is induced.

(c) The reduction of obesity. As previously mentioned, hot baths and packs increase the rate of oxidation and, if the intake of liquids is restricted, diaphoresis, by promoting the need of water in the body, tends to augment the catabolism of fat, which yields water to the body.

When heat is applied to a limited area of the body, as an arm or leg, results may be obtained that are of great therapeutic value in certain inflammatory conditions and in stiffening of the joints such as frequently follows injury, disuse, and certain diseases, especially acute rheumatic fever, septic infection, and gout. These are: (a) Softening and expansion of fibrous tissue[1] (the ligaments and tendons holding the bones together at their joints and attaching the muscles to the bones are, it will be remembered, of fibrous tissue). (b) Muscular relaxation. (c) Hyperemia.

The change in the fibrous tissue is partly the result of improvement in the circulation and partly of the direct effect of heat upon the tissue cells.

Important results of hyperemia are:

(a) There will be, as the result of the congestion in the blood-vessels of the part, an increase in the amount of blood-serum exuding into the tissues and,

[1] Why does heat cause the expansion of matter? If not able to answer see in section Effect of Heat upon Matter, in textbook of Physics.

as this contains leucocytes, opsonins, and other antibacterial substances, this will favor the destruction of bacteria. (b) Absorption of inflammatory exudates is helped. (c) Eventually, the circulation in the part will be improved.

The Therapeutic Uses of Hot Baths and Packs

The chief therapeutic uses of heat in the form of baths and packs are:

(1) To induce perspiration and thus, (a) when the kidneys are not functioning properly, aid in the removal of salts and protein waste from the body; (b) reduce edema; (c) lessen obesity.

(2) Relax excessive muscular contraction, as for example, in convulsions.

(3) To lower blood-pressure.

(4) To relieve congestion of the internal organs and membranes. One of the common reasons for doing this is to "prevent a cold."[1]

(5) To hasten the outbreak of rash in measles and other exanthemata.

(6) To relax stiff joints and overcome local inflammations.

The varieties of hot packs are dry and wet and the combined bath and pack. For systemic effects the

[1] When the surface of the body is chilled by, for example, remaining in drafts or in wet clothing, an unusual large amount of blood is driven from the skin to other parts of the body and parts especially susceptible, as the tonsils, nasal mucous membranes, and contiguous structures, are likely to become congested. This condition is favorable for the multiplication and activity of various bacteria very commonly present in the mouth and respiratory passages, which cause "colds," tonsillitis, and other infections of these parts. If the congestion is relieved, however, before the bacteria gain ground the infection may be averted.

whole body, except the head, is enclosed in the pack, but, for local effects, as a rule, only the affected area is included.

The varieties of hot baths in common use are the hot water bath, the hot air or modified Turkish bath, the vapor or modified Russian bath, electric light and sunlight baths. As in the case of packs, baths are used both for the whole body and for limited areas.

The emergencies most likely to arise in the course of these treatments are:

1. Burning the patient. This for obvious reasons is most likely to occur with packs and vapor and electric light baths.

2. Fainting, due to withdrawal of blood from the brain into the relaxed skin vessels.

3. Collapse, caused, as a rule, by the reduced blood pressure.

4. Chill. This is usually occasioned by (a) exposure to a comparatively low temperature during or too soon after the treatment; (b) insufficient drying of the skin. The chill in both cases will result from the cold produced by evaporation, this not being intense enough to call forth the reflexes which give rise to reaction nor associated with the necessary auxiliary treatment.

5. Headache, resulting chiefly from the effects of the heated blood within the cerebrum.

Means that must be taken to avert accidents:

To avoid burning patients (a) always take the temperature of the water with an accurate thermometer and be sure that it is the required degree; (b) when adding water to a bath after the patient is in it always hold your hand between the patient and

the stream of hot water; (c) when giving wet packs, wring the blankets as dry as possible, and (d) never put the hot-water bags next to the wet blanket, for this may generate steam. The special care necessary during local hot baths will be given in the section describing the methods of their administration.

To prevent fainting and collapse (a) keep patients quiet during and for some time after treatments and do not allow them to sit or stand up suddenly; (b) unless there is edema or the treatment is given to reduce obesity give liquids by mouth liberally, for the loss of fluid from the blood, as already said, helps to reduce blood pressure and this is usually the chief cause of collapse. Of course drinks are withheld or given sparingly when there is edema for the blood can then get the liquid from the tissues and it will not do so, as desired, if liquids are taken by mouth. Neither are drinks to be taken when the treatment is to reduce obesity, since they would prevent the accomplishment of the object of the treatment, but as, in this case, the water is supplied to the blood very slowly, it is particularly necessary to watch for adverse symptoms and employ the other means to prevent undesirable effects.

To prevent chilling all the conditions mentioned as likely to cause it are to be avoided and, at the completion of the hot treatment, an alcohol rub or effusion of cold water is given because the reactionary effects mentioned in the section describing the action of cold bring about a condition of muscle tone and improvement in the circulation which prevent chilling and congestion such as is produced by cold that is not sudden or intense enough to occasion reaction.

To avert headache, keep an ice-cap on the head

during, and for some time after, the pack; how long, will depend upon the patient for some people are not much affected in this way by the heat and others are very much troubled.

Signs that heat is having an undesirable effect are: Feelings of faintness and dizziness, increasing weakness and rate of the pulse.

Should these all occur, discontinue the treatment at once and rub the patient with alcohol and, of course, the physician should be notified, but increase in the rate of the pulse without the other symptoms, especially the two first mentioned, is not a bad indication for the relaxed condition of the vessels naturally produces a softer and quicker pulse.

Demonstration 45

The Hot Bath-Pack

In hospitals equipped with a hydrotherapy room, this treatment is generally given there, the patient being taken from and returned to the ward on either the bed or a stretcher, but it can be given very easily in the ward or the demonstration room, using a portable tub. The procedure in all cases can be practically the same.

As in the case of the cold treatments described in the preceding section, the hospital doll, if covered with waterproof material, can be used for all of the lessons in this section, but the pupils are strongly advised, when practicing, to take turns "being patient."

Equipment: 1. A portable tub about half full of water of the required temperature. The temperature is of course ordered by the doctor; a common prescrip-

tion is 104° F. to begin with and an increase to 106°, 108°, 110°, and even, if the patient is not depressed by the lower degrees, 115° F. Unless the bath is prepared at the bedside, the first temperature will need to be a degree or two higher to allow for cooling in transportation.

2. A large bucket or hose for conveying the hot water required to raise the temperature.
3. A bath stretcher.[1]
4. A rubber ring or air pillow.
5. An ice-cap with cover.
6. A bath thermometer.
7. Three cotton bath blankets.
8. One heavier blanket.
9. Two rubber sheets.[2]
10. A rubber pillowcase.
11. Five covered hot-water bottles.
12. A loin binder and safety pins.
13. A bath towel and a dressing towel.
14. A bottle of alcohol 50%.

Procedure: Ascertain if the temperature of the bath is correct.

Feel the patient's pulse.

Replace the upper bed covers with a bath blanket, remove the nightgown, and pin a binder around the groin.

Move the patient on to the stretcher and lift her into the bath in the same manner as described for the Brandt bath.

Place the ring under and the ice-cap on her head.

[1] In actual practice the patient is often well enough to step into and from the bath and, in such case, the stretcher is not needed, and a bath mat and either a chair or stool are substituted.

[2] Only one will be needed if the stretcher is not used.

Feel her pulse now and from time to time during the bath.

The time prescribed for the bath is, usually, fifteen minutes. After one third of this time has elapsed start pouring in hot water and do this at intervals until the maximum temperature ordered by the doctor is attained; unless otherwise directed, this should be reached before two thirds of the bath time has passed. Pour the water used to increase the temperature in at the foot of the tub and *keep your hand between the stream and the patient*, alternately with pouring, from time to time facilitate the mixing of the added water with that in the tub by moving your arm through the water. The temperature of the added water must depend upon the relative size of the tub and the patient, if there is room to allow sufficient space between your hand and the stream of water, it can be almost, if not quite, boiling.

While the patient is in the tub **prepare the bed,** and do this as soon and as quickly as possible, for it may be necessary to take the patient out of the bath before the prescribed time has elapsed. Unless this seems probable, strip the bed, turn the mattress, and make an open bed in the usual manner with the upper covers folded to the foot. Unless the patient is troubled with dyspnea or other reason exists why one pillow under the head will not suffice, provide only one. Put the rubber pillowcase on under the white one.

Then, cover the bedding with the rubber and this with a bath blanket, on top of this spread the thicker blanket and on this a bath blanket. Place all the blankets so that they will extend about two inches above the patient's neck and below her feet.

Place the hot-water bottles near the center of the bed, but a little bit farther to the side opposite the tub. Cover these with the remaining bath blanket.

Cover the side of the bed next the tub (over the three blankets, but not that covering the hot-water bottles) with a rubber.

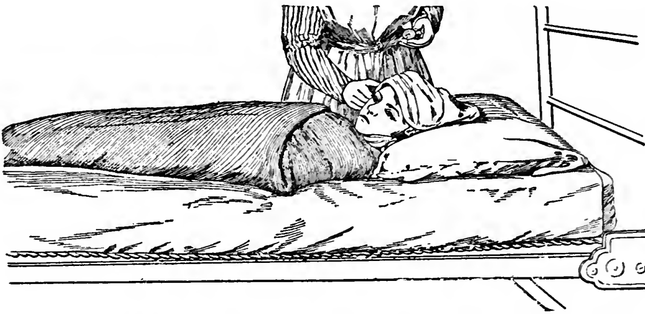

Fig. 25. Manner of folding blanket over shoulders in hot pack.

When the bath time is just about over, remove the hot-water bottles and put the blanket covering them across the bed and tub as you did the sheet to prevent exposure in the Brandt bath (see page 198).

Unpin the binder, leave it in the tub for the present.

Raise the stretcher and place it on the part of the bed covered with the rubber.

Loosen the blanket from the tub and move the latter out of the way. Dry the patient as well as possible by rubbing her over the blanket. This need not be thorough, it being far more important not to expose the patient and to get her wrapped in the blankets as quickly as possible, for these will, in any case, soon become wet with perspiration.

Draw the patient off the stretcher to the center of

the bed. Remove the stretcher and the rubber under it.

Draw up the sides of each of the two top blankets that are under the patient and, separately, tuck them around her in the same way that you tucked the blanket for the cold pack, Method 2; being careful to draw the blankets particularly snugly around the shoulders and the feet. Do all this under the blanket that you put over the patient before she was taken from the bath and remove this blanket.

Put a towel under the edge of the blankets around the neck.

Put the hot-water bags along the sides and at the feet and then draw up the sides of the lower blanket over these and the patient. This need not be wrapped quite so snugly as the other blankets.

Draw up the covers.

Replace the ice-cap on the head.

Count the patient's pulse and note its character. Record this and the patient's general condition during the bath as soon as possible.

Put away the bath equipment and hang the blanket where it will dry.

Unless there is edema, or the treatment is given to reduce obesity, give about two ounces of ice water or other beverage every ten minutes. When there is much edema, the usual rule is to restrict liquids as much as possible and, in order to do so, without rendering the treatment unnecessarily uncomfortable, either wash the patient's mouth or allow her to rinse it with ice water or lotion as often as necessary.

The patient is usually left in this pack for thirty to sixty minutes. When half the time is over, remove the hot-water bags. At the end of the time,

turn down the covers and then remove the two blankets next to the patient. Do this under the cover of the outer one and do not expose the patient.

Rub the patient with alcohol, using a liberal supply.

Draw up the bed covers, leaving the rubber and the bath blanket covering it in place with the sides of the latter loosely over the patient until she ceases to perspire profusely. If she does not do so soon give another alcohol rub. As soon as diaphoresis ceases, remove the blanket and rubber and put on the nightgown.

When a stretcher is not used, there will be the following differences in procedure:

1. Do not draw the tub close to the bed, but place a bath mat and stool between them. The stool will be needed for the patient to sit on if she feels faint when she steps from the tub and, if the bed is high, to make it easy for her to get in.

2. Do not put the blanket that is over the hot-water bottles across the bed and tub, but, after the patient steps from the tub, put it around her with the opening at the back and remove the binder after you have done this.

Demonstration 46

The Hot Wet Pack

Equipment: 1. A foot t ub or large pail.

2. A safety pin.

3. Two rubber sheets.

4. Five hot-water bottles.

5. Four bath blankets, two of these should be small ones.

6. One thick blanket.

7. Five hot-water bag covers.
8. Ice-cap with cover.
9. Bath towel.
10. Face or dressing towel.
11. Alcohol 50%.

Procedure: Half fill the bathroom bath tub with water 180° F.

Fold one of the small bath blankets lengthwise and submerge them both (except two corners diagonally opposite each other of each blanket) in the water; pin the four corners over the faucet. This is to keep enough of the blankets out of the water to supply dry places to hold when wringing the blankets. Some hospitals supply wringers, made of crash or ticking, with a hem at each end through which sticks can be passed for wringing the blankets, but these are unnecessary and as this form of wet pack is very commonly used in "private nursing," where a wringer could not easily be obtained, it is much better for nurses to do without them in the hospital.

Line the foot tub with a rubber sheet leaving the margin of the latter free, put the filled hot-water bags (uncovered) into this and cover them with the free portion of the rubber.

Put, one on top of the other in the following order, the bath blanket, rubber and thick blanket, with the blankets extending three inches beyond the rubber at one end. Fold or roll these together and take them with the remainder of the equipment (*i. e.*, 7, 8, 9, 10, 11) to the bedside.

Replace the upper covers with the bath blanket in the usual manner, folding down the former to the foot of the bed.

Pass the blankets with the rubber between them

under the patient in the same manner as the under sheet when making a bed. Before drawing the patient on to them arrange their position so that the upper edge of the rubber will be on a line with her neck and that of the blankets three inches higher.

Take off the nightgown.

Put the dressing towel over the upper edge of the covering blanket, under the patient's neck.

Draw up the covers.

Place the ice-cap on the patient's head.

Go to the bathroom. Take the temperature of the water in the bath tub. This should now be between 150° and 160° F. If you have been so long doing your work that the temperature is lower than this, add more hot water.

With the help of an assistant, wring the blankets, do the unfolded one last. To do this, each take a dry corner and twist in opposite directions. Wring the blankets as dry as possible and work quickly, when you finish each blanket, put it into the foot tub with the hot-water bottles and cover them with the margin of the rubber. Have the folded blanket on top as it will be needed first.

Carry the tub with its contents closely covered to the patient.

Fold the bed covers to the foot of the bed.

Turn the patient on her side.

Under cover of one side of the bath blanket that is over the patient, spread the folded blanket (keeping it doubled) on the bed where the patient will lie on it. Turn the patient on to it.

Put the ice-cap on her head.

Under cover of the bath blanket, put the other

wet blanket over the patient, bring it, on each side, around an arm and put it down between the legs—no two surfaces of the patient's body are to be in contact.

Turn the sides of the bath blanket that is covering the patient over her and bring up the sides of the upper dry blanket and fold these across her shoulders and over her body as you did the blanket in Demonstration 44, Method 2, being very careful to draw them snugly around the neck and feet.

Put the covers on the hot-water bags and place them one at the feet and two along each side.

Bring the sides of the rubber up over the patient and fold the under blanket around her.

Arrange the towel between the blankets and the patient's neck.

Feel the patient's pulse at the temporal or facial artery and do this frequently during the pack.

Draw up the bed covers.

If possible have an assistant when putting a patient in a hot pack as it should be done quickly.

The rules regarding the giving of drinks are the same as for the bath pack.

A patient is never to be left alone while in a pack. If she is in a ward and in good condition, it may not be necessary to remain at the bedside, but you must arrange the screens so that you can watch her and never go so far away that you will not hear if she speaks to you.

If the patient remains in good condition the pack is usually continued for twenty minutes.

When the time is over, turn down the bed covers, remove the hot-water bottles, the upper wet blanket, the rubber, the blanket covering this, and the wet blanket under the patient. To remove the last three

articles turn the patient on her side, roll the blankets and rubber to her back, dry her back, turn her over on to the dry blanket (which was under the rubber) and remove the roll. Keep the upper bath blanket over her while you are doing this.

Dry the patient thoroughly, bring up the edges of the under blanket and fold them around her under cover of the other blanket. Remove the latter and at the same time draw up the covers. Replace the ice-cap on her head.

Leave the patient thus for about an hour, then, dry her thoroughly, rub her with alcohol, and replace her nightgown. To do this, bring a dry bath blanket, replace the covers with this and work under it. When you have finished, remove this blanket at the same time as you draw up the covers.

Demonstration 47

Local Hot Pack

In the treatment of stiff joints local hot packs are very often used when electric and vapor baths cannot be obtained.

Equipment: 1. A pillow with a rubber under the white case.

2. A piece of rubber sheeting large enough to envelop the part that is to be treated and two hot-water bags.

3. Two pieces of bath blanket or flannel somewhat smaller than the rubber and one slightly larger.

4. Two hot-water bottles, covered.

5. A basin of water about 190° F.

6. A crash towel.

Procedure: Put one of the smaller pieces of blan-

ket in the crash towel and submerge this, except the two ends, in the water.

On the pillow, place (1) the larger piece of blanket, (2) the rubber, (3) a small piece of blanket.

Draw the pillow with its covers into position, lifting the limb, if it is painful, as described in Demonstration 20.

Wring the water from the wet blanket by twisting the ends of the towel in opposite directions and get it as dry as possible, and do not have it hotter than you can bear on your own hand.

Put this around the affected part with the opening underneath. Bring the dry blanket over it. Place a hot-water bag on either side. Bring up the rubber and then envelop the whole in the under blanket fitting this as snugly as possible without causing pain.

When, as is often the case, this treatment is continued for an hour or more, the wet compress must be changed about every half hour. In such case an extra piece of flannel or blanket will be needed as the compress in use is not to be removed until the fresh one is ready.

Supply freshly filled hot-water bags with every other change of compress, *i. e.*, every hour.

Demonstration 48

Vapor Baths

Various types of cabinets are generally used for the modified Russian or vapor baths given in hospitals.

The kind of cabinet very commonly used is one which surrounds the patient when she is seated with-

in it. The steam either enters through pipes or is generated by boiling water on, preferable, an electric stove within the cabinet.

Equipment[1]: 1. The bath cabinet and, if there is no base to it, a heavy rubber to protect the floor, unless this will not be injured by moisture.

2. A bath thermometer.

3. The apparatus for generating heat. See below.

4. A chair, unless there is one in the cabinet. An old wooden one is best, metal being likely to become too hot.

5. An ice-cap.

5. Two bath blankets.

7. A rubber sheet.

8. A face towel

9. A bath towel.

10. Slippers.

Procedure: Arrange the cabinet. Two important points to be considered in doing this are: That the apparatus for generating vapor must be so placed that a stream of steam will not flow directly upon the patient and, if the heating apparatus is within the cabinet it is to be fixed where there will be no danger of its being overturned or setting fire to anything. The best place to put it will depend upon the shape and size of the cabinet. A good arrangement with small cabinets is to put a heater and basin of boiling water in a foot tub and place this somewhat under the chair, but far enough to the

[1] When the cabinet is not in the same room as the bed there will be needed, in addition to the articles required for demonstration, a stretcher or wheel-chair and a thick blanket or two to cover the patient during transportation.

back to prevent the steam coming against the patient's legs.

Undress the patient, if she is not in bed, wrap a bath blanket loosely around her. Put on her slippers.

When the patient is in position in the cabinet, if the heating apparatus is under the chair, see that her legs are well protected with the blanket. Close the cabinet and place the ice-cap on the patient's head.

Arrange the bed. Fold the upper covers to the foot of the bed and cover the bedding with the rubber sheet and this with a bath blanket.

When the time for the bath is over, usually twenty minutes, turn off the heat. Dry the patient quickly under the blanket, let her remain seated while you do so.

Help her into bed, turn the blanket so that the opening will be in the back while you do so. Remove her slippers. Wrap her in the blanket that is on the bed, under the one surrounding her, and then remove the latter. Draw up the bed covers. Put the ice-cap on her head.

The treatment during and after the bath is the same as for the wet pack.

Demonstration 49

Hot-Air Bath in Bed

The details of the procedure in giving hot-air baths depends considerably on the nature of the appliances provided for the purpose however the aims in all methods are to arrange the apparatus in such fashion that there will be no escape or entrance of air and

to obviate all danger of burning the patient. The description given here calls for a simple box-like cabinet which fits over the patient when she is lying on the bed or else the substitutes specified.

Equipment: 1. A rubber sheet, this should be large enough to envelop the cabinet and it should be brought to the bedside covered with a blanket which should extend about six inches beyond the rubber at the top. These should be rolled or folded ready to put under the patient as in Demonstration 46.[1]

2. A bath blanket (in addition to that with the rubber).

3. Safety pins.

4. A long chemical thermometer.

5. An ice-cap.

6. A bath towel.

7. A face towel.

8. Pipe for conducting the hot air and, if necessary, a stand or support.

9. Bunsen burner or whatever appliance is used for generating the heat.

10. Cabinet or substitute, viz.: (a) one or more cradles, the number required will depend upon their size, they should extend from the foot of the bed to about over the patient's soulders; (b) two blankets;

[1] The reason for arranging these articles before bringing them to the bedside is that in a ward, there is seldom a table large enough to spread them out on while putting them together and unless this is done properly it is hard to get them smooth, and if they are placed on the bed separately, as is sometimes done, it is difficult to get the roll or fold small enough to bring the patient over it easily when turning her back on to the portion of the bed that you have covered.

(c) two rubber sheets; (d) a piece of asbestos to put between the stovepipe and the blankets.

Procedure: Count and record the pulse. Replace the bed covers with a bath blanket as described page 63; remove the covers from the bed and hang them over a chair or screen.

Put the rubber and blankets under the patient in the usual manner, see page 236, and have them extend up over the pillows, how far, will depend upon the nature of the cabinet or substitute used; they must be high enough to fold over the patient's neck and shoulders and reach considerably above the rim of the cabinet or cradle so as to prevent air leaving or entering the bath.

Remove the nightgown.

Put the face towel between the blanket and the patient's neck.

Place the ice-cap on her head.

Put the cabinet in position or, if there is no cabinet, the cradles and, over the latter, put the two blankets allowing these to lap about two inches and one to extend over the cradle at the foot and the other at the top sufficiently for the lower one to be tucked under the cradle at the foot and the other under the patient's shoulders. Put the rubbers over the blankets, and both rubbers and blankets under the cradles along the sides and foot and under the patient's shoulders at the top. Arrange an aperture either at the foot of the bed or at the side, where the blankets and rubbers meet, in which to introduce the pipe.[1]

[1] Unless the patient is small or the bed wide, it is usually better to put the pipe at the foot of the bed as there will be more space there between the patient's body and the incoming air.

Bring the sides of the blanket and rubber that you put under the patient up over the cabinet or covered cradles lapping them across the chest. Pin the blanket, if necessary, to keep it in place.

Insert the thermometer. Cabinets are provided with a hole and holder for the purpose. If cradles are used, tie the thermometer to the lower cradle, near the top, putting it where the blankets and rubbers lap; allow the top to project from at least slightly below the mark of the bath temperature, and do not allow the lower portion to be in the patient's way. Pin the blankets firmly around the thermometer.

Put the pipe in place. If cradles are used, cover the part that will come in contact with the rubbers and blankets with asbestos, unless as is sometimes the case, the pipe is permanently covered with this material.[1] Cabinets, as a rule, have metal or other non-inflammable material at this point, of course, if the one used has not, it must be protected from an uncovered pipe.

Adjust and light the heating apparatus.

Spread the bedclothes neatly over as much of the cabinet, etc., as possible, without interfering with the thermometer.

The temperature prescribed for a hot-air bath is usually between 120° and 160° F. and the duration is usually fifteen or twenty minutes from the time the temperature reaches the prescribed degree, provided the patient shows no ill effects.

The same precautions and care are necessary during the bath as for the packs.

[1] It is better when the pipe is so covered, since, otherwise, there is a great loss of heat from the pipe and it takes longer to get the desired temperature in the bath.

When the bath time is over, remove the source of heat, but allow the patient to remain undisturbed for about thirty minutes, then remove the cabinet or its substitute and, under cover of the bath blanket rub the patient with alcohol, remove the rubber and blanket under her, put on her nightgown, draw up the covers, and at the same time, remove the bath blanket.

Continuous Hot-Air Baths

Continuous hot-air baths are often used in the so-called *open treatment* of burns in order to: (1) promote a general stimulation; (2) keep the skin active; (3) prevent irritation of the wounds by dressings and exposure to changes of temperature.

One very essential difference in a bath that is to be maintained indefinitely and one ot short duration is the temperature. This, for a continuous bath, must not be high enough to interfere with heat elimination[1] and, therefore, must be somewhat below body temperature[1]; 90° F. is a degree that is frequently prescribed.

A common method of arranging such a bath is as follows:

Cover the mattress with a large rubber and this with one (or more if thin) old blanket, and these with a muslin sheet; it is most essential to stretch these covers tightly before tucking them under the mattress and to tuck them far enough under the mattress to keep them absolutely free from wrinkles. If there are burns on the under surface of the patient's body a

[1] Why? If unable to answer see pages 148 to 150.

folded sterile sheet is usually placed where they come in contact with the bed.

Over the patient place cradles, as described on the preceding page, and over these drape two sheets (one covering the top and the other the foot of the cradle, and overlapping each other in the center), or thin dimity spreads.[1] Arrange the thermometer and the heating apparatus in place as in Demonstration 49. The burns are left exposed, without dressing or covering other than that over the cradle.

An ice-cap is usually kept on the head and the patient given frequent drinks, for keeping the kidneys flushed is an essential part of the treatment.

Demonstration 50

Local Hot-Air Baths

A very common form of treatment for stiff joints is to expose them to a high temperature (200° to 300° F.), for about twenty minutes daily, and to follow this by massage. The benefits that can be derived from heat under such circumstances have been already discussed, see page 225.

The cabinets used for this treatment vary in size and shape according to the part for which they are to be used. They are usually made of metal and lined with asbestos, for the latter does not absorb nor part with heat as readily as metal and, therefore, will not scorch nor set fire to the material protecting the body

[1] Sometimes it is necessary to have additional covers over the cradle in order to maintain the desired degree of temperature, but it is better not to have them unless absolutely necessary, for, without them, the air over the wounds is kept purer.

as quickly as metal will. The modern cabinets are heated by electricity or electric lights.

Equipment: 1. A cabinet.

2. Protectors. Protectors are usually made of two to four (according to the thickness of the material) layers of either flannel, old blanket, wadding stitched between gauze, or Canton flannel. Those made to fit the part loosely—*e. g.*, mitten and sleeve-shape for the hand and arm, stocking-shape for the leg and thigh, are better than those that are wrapped about the part, because they can be adjusted with less delay and movement and, should the protector take fire through carelessness, the limb can be withdrawn more quickly.

The more essential points to be considered in giving this treatment are as follows:

1. The patient must be comfortable during the treatment, therefore, arrange the height and position of the cabinet so that she can lean back comfortably in her chair and make sure that there is absolutely no strain on the muscles of the part that is being treated.

2. If the patient has on a ring or rings remove it or them, *even a wedding ring*, for metal absorbs and conducts heat so readily that a ring may become hot enough to burn the flesh.

3. Dry the part that is to be treated.

4. Envelop the part in a protector, because even asbestos will become hot enough to burn the flesh if the surrounding temperature is 200° F. while the materials used for protectors do not.[1]

5. Never put pins in a protector because, for the

[1] For reasons, see **Physics,** under the specific heat and relative heat of substances.

reasons given under Precaution 2, they may set fire to the latter.

6. Before putting the part to be treated in the cabinet make sure that the asbestos is in place and intact. Protectors have been set on fire by exposed screw heads and areas of metal.

It must be appreciated that a temperature of 300° F., and even 250° F., is exceedingly near the kindling temperature of materials that will serve for protectors.

7. Look at the thermometer every few minutes.

8. Never, under any circumstance, leave a patient alone during a treatment.

As a rule in the local bath there is not enough of the body exposed to the high temperature to produce pronounced systemic symptoms, but if a patient is affected arrange the bath so that she can lie down during the treatment or, if this is impossible, lean forward and rest her head on a pillow placed on a table. If a bath induces a headache put an ice-cap on the head during future treatments.

The Sitz Bath

The sitz tub, in which this form of bath is given, is so fashioned that a person can sit with her feet on the floor, the upper portion of her thighs and her abdomen immersed in water, and her back resting against that of the tub.

The purpose of this treatment is to relieve congestion of pelvic organs. This it does by relaxing the muscles and the superficial blood-vessels of the parts exposed to the heat, a condition that, as explained in the section on the action of heat, favors an excess

amount of blood in those parts and its consequent withdrawal from congested areas.

Procedure: See that the bathroom is warm and fill the tub to from one half to two thirds its capacity (depending upon the size of the patient) of water the required temperature. This is usually 110° or 115° F.

Clothe the patient in an undershirt, folded above her waist line, stockings, and slippers, and pin a bath blanket around her neck with the opening in the back. Fold a towel over the upper edge of the blanket where it is in contact with the patient's neck.

The first time the patient has the treatment tell her that the water is hot, but that it cannot burn her.

Hold the blanket so that it will not get wet while the patient seats herself in the tub and then arrange it enveloping patient and tub.

Usually, an ice-cap is not required, but use one if the treatment gives the patient a headache.

If it is necessary to raise the temperature of the water during the bath, keep your hand between the patient and the inflowing stream.

Put a chair where the patient can sit down as soon as she steps from the tub at the completion of the treatment, which is as a rule, in twenty minutes. Dry her, keeping the blanket around her while you do so.

If the patient is not confined to bed, it is best to give this treatment just before she retires for the night, but, if this is not possible, caution the patient to remain as quiet as possible for some hours, as otherwise, she may not reap the full benefit of the treatment.

Demonstration 51

The Foot Bath

The common therapeutic purposes of this treatment are: (1) To relieve congestion in distant organs as the throat in tonsillitis, the lungs in pneumonia, the pelvic organs in dysmenorrhea; (2) to relieve local congestion and stiffness such as exist when the ankle is sprained.

That the treatment can relieve congestion in distant organs is due to the fact that if an extra mount of blood is diverted to any one portion of the body there must be less in other parts and, thus, any area in which there is an abnormal amount is likely to become more or less depleted.

The means by which the treatment attains its actions were described in the preceding section and in that on the action of heat.

Equipment: 1. A foot tub half full of water, usually 110° or 115° F.

2. A bath blanket.
3. A bath towel.
4. A face towel.
5. A covered hot-water bag.
6. A bath thermometer.

Procedure when the patient is in bed: Loosen the upper bed covers at the foot of the bed.

Double the bath blanket lengthwise and then fold it in four with the two ends on either side of the central fold.

Place this across the foot of the bed, under the loosened covers with the ends toward the foot. Standing near the foot of the bed, take the upper one

of these between your third and fourth fingers and the bed covers between your other fingers and thumbs and turn the covers back to above the knees, carrying up the blanket over the legs at the same time.

Flex the patient's knees.

Turn back the lower portion of the blanket so that it will cover the part of the bed on which the tub is to rest.

Fig. 26. Foot bath. The blanket has been drawn up to show the manner of holding the feet while putting them into the tub, ordinarily they should not be exposed.

Place the tub on the bed, near the feet, over the lower fold of blanket.

Put your arm that is nearest the head of the bed under the patient's legs and your hand under her heels.

Put your other arm across the tub, grasping it on the far side, and move it forward into position while, at the same time, you raise the feet and legs from the bed. This is done under the top layer of blanket, the arm being kept across the tub to prevent the blanket getting into the water.

Before lowering the feet into the water, tell the patient that it is hot, but that it cannot possibly burn her. Put the feet in slowly and, if the patient objects to the heat, raise and lower them alternately for a short time until she becomes accustomed to it.

Put the edge of a folded towel between the patient's legs and the rim of tub; be sure that it is not near the water.

Take hold of the upper edge of the blanket and hold it in position, while with your other hand you draw down the covers.

Roll the hot-water bag in the bath-towel (to warm the latter) and place it under the covers.

The feet are kept in the water for from twenty to thirty minutes. If it is necessary to raise the temperature of the water, bring some water that is about 150° F., in a pitcher, and pour it in slowly, keeping your hand between the patient's legs and the stream. This can be done without uncovering the tub except at the point where you are pouring in the water.

To remove the tub: Turn the bed covers back above the knees, but leave the blanket covering the legs. Take the bath towel from the hot-water bag and pace it on the far side of the tub. Take the towel from behind the patient's legs.

Put your arm under the legs as when putting them in the tub, raise them from the water and hold them over the tub for a few seconds, that the water may drain from them, then put one side of the layer of blanket that is covering them around them and lower the feet on the bath towel.

Remove the tub. Dry the feet and then remove the blanket from underneath them.

Put the hot-water bag at the feet.

Draw down the covers and, with them, the blanket. Remove the latter and tuck the covers under the mattress as usual.

Procedure when the patient is not in bed:

Provide a comfortable chair and over the outer edge of the seat and the floor spread a heavy colored blanket.

Have the patient sit on the chair, remove her shoes and stockings and turn her skirts up above her knees.

Put the tub in position, place the patient's feet in the water and envelop her legs and the tub with the blanket.

Warm or Sedative Bath

Anatomical and physiological conditions upon which the action of warm baths depend: Directly under the epidermis, are innumerable nerve endings which are stimulated in different ways, *e. g.*, some are stimulated by heat, others by cold, others by pressure, others by touch; therefore such things as exposure to temperature much higher or lower than that of the skin, currents of air, pressure of clothes, and movements of the muscles result in a constant inflow of impulses from the periphery to nerve centers in the cord and brain. Also, impulses are, while the individual is awake, incessantly passing to the brain from the eyes and ears. As the result of these afferent impulses, there is a constant stimulation of nerve centers and a continuous discharge of efferent impulses to the muscles.

On the contrary, if a person lies comfortably in a bath that is about the same temperature as the skin, in a quiet, dark, or dimly lighted room, peripheral

stimulation is reduced to a minimum and, consequently, the stimulation of nerve centers. As a result of this the muscles become more or less relaxed. The relaxed condition of the muscles and the lessened stimulation of the vasoconstrictor centers result in an increase in the amount of blood in the skin and the eventual diminution of that in the brain, a condition which inhibits mental activity and favors rest and, as the result of rest, provided the anemia is not excessive, recuperation of nerve centers.

Warm baths are used in therapeutics: (1) As sedatives for the central nervous system in the treatment of the excitement of mania, insomnia, and nervous exhaustion, and as a preventative of nerve fag during periods in which an individual is subjected to nervous strain from any cause. (2) As peripheral sedatives in the treatment of certain skin diseases and of extensive burns.

A bad effect that, unless some means is taken to prevent it, may follow the daily use of warm baths is an increased susceptibility to *taking cold;* this, however can be prevented by taking the warm bath at night and a cold one in the morning. The latter would probably be counterindicated in the skin diseases for which a sedative bath is used and, of course, it is not used for a burned person.

The temperature of a bath used for sedative purposes is, usually, about 96° F., the desideratum being to have it near enough the skin temperature not to arouse stimuli and yet not hot enough to prevent heat elimination.

The duration of a sedative bath varies from about one half hour to several hours, or, in the treatment of burns, it is practically continuous, the patient, as a

rule, being removed only when necessary for evacuation of the bowels and bladder and for treatments.

Points to be considered in the giving of this treatment are: (1) The patient must be as comfortable as possible and all strain prevented (such as, for example, will be induced if she has nothing to brace her feet against when they do not reach the foot of the tub). (2) The temperature of the water must be maintained. (3) If the bath is used as a central sedative, quiet is essential and the room must be dark or only dimly lighted and (4) the patient is to be dried quickly and go to bed at once. This is especially essential when the treatment is used for insomnia.

Means to secure comfort beyond, when necessary, putting something for the patient to brace her feet against, are only required when the patient is physically exhausted or when the bath is to be continued for a considerable time. In either of these cases a support for the head and shoulders is generally desirable. This usually consists of a band of canvas or of two layers of flannelette, about twenty-seven inches wide, which is fastened across the top of the tub, being stretched fairly tight where the head rests and allowed to sag under the shoulders sufficiently to allow the chest to be submerged in the water; the difference in the tension of the support must be gradual so that it will provide a comfortably slanting support for the back. In hydrotherapy departments, tubs used for these purposes are usually provided with hooks or bars to which such supports can be fastened. A good substitute on an ordinary tub is to tie a cord around it under its rolling edge; this will prevent it sliding up, and, to hinder the cord from falling, tie

it to the base of the faucet, and, at the top, pin the upper and side edges of the support around it with strong safety pins. A rubber air ring or cushion is, as a rule, needed under the head.

When the bath is to be continued for several hours it is sometimes well to put a folded bath blanket along the bottom of the tub, for the patient to lie on.

To keep the water warm when the bath is to be continued for any length of time (1) cover the tub. A doubled blanket is best used for this purpose and, to keep it out of the water, two or three slats of wood can be placed under it, across the tub, or, if these cannot be obtained, pin it to the bars of the tub or to their substitute, *i. e.*, the cord around the tub. For a continuous bath, place a rubber sheet over the blankets and, in order to attain a neat appearance, drape a sheet or dimity spread over this and around the tub. (2) Add hot water when necessary. In doing this keep your hand between the patient and incoming stream and occasionally, stop the flow and mix the water by stirring your hand through it. While doing this, when the bath is used as a central nerve sedative disturb the patient as little as possible and avoid conversation.

In the treatment of burns a hammock, such as is used in the Brandt bath, is provided for the patient to lie on so as to facilitate the lifting from and to the bath when necessary to remove her for treatments, etc.

Twice a day while the patient is out of the bath scour it thoroughly.

As a rule, when the bath is used for this purpose, boric acid sufficient to make a one per cent. solution is added to the water—see page 258—and the patient's

skin is smeared with vaseline or ointment in order to prevent its excessive maceration.

Medicated Baths

Under this heading may be classed all baths to which drugs of any kind have been added.

The most common uses of such baths are:

1. To alleviate skin affections. The medicament used for this purpose is generally either an antiseptic, as boric acid; a parasiticide, as sulphur; a bland substance to allay irritation, as bran; or one that will allay itching, as sodium bicarbonate.

2. To, by chiefly stimulating sensory nerve endings in the skin, promote a general stimulation of the nervous system and thereby improve the circulation, increase the amount of blood in the derma and muscles and thus relieve congestion of the viscera. Under this heading may be classed mustard and the various salts used for baths such as the imitation Nauheim and Carlsbad salts.

The temperature of medicated baths depends upon their purpose: Those used to allay skin irritation, naturally, are of a temperature that will have a sedative effect—about 96° F. The stimulant baths, on the contrary, with the exception of mustard, are colder—*i.e.*, between 85° and 65° F. The temperature of mustard baths depends upon whether a counterirritation due solely to mustard (see page 437) is wanted or whether the effects of heat are also desired. In the former case, the temperature of the bath is usually between 96° and 100° F. for, if the water is hotter than this, the strength of the mustard will be diminished (for reason see page 437), but

mustard is sometimes added to baths of about 105° to 112° F., with the expectation of inducing a slight irritation which will augment the effects of heat in relieving internal congestion.

The method of giving medicated baths depends upon their purpose and temperature. Baths below 75° F. are given as described under cold baths; those between 90° and 100° F., as described under sedative baths; and those above 100° F., as described under hot baths. When baths are given to allay skin irritation, the patient is dried by wrapping her in a warmed sheet and gently patting over this—*an irritated skin is not to be rubbed.* After a stimulant bath, on the contrary, a brisk rubbing is usually indicated, the reasons for this have been already discussed.

The methods of preparing, and the amounts of medicament to use, for the baths mentioned at the beginning of this section are as follows:

The bath tub is filled to, depending upon the size of the patient, ½ to ¾ its capacity. An ordinary sized tub—about five feet—contains approximately twenty-five gallons—*i. e.*, one hundred quarts.

For a boric acid bath, dissolve the boric acid powder (using one ounce for each gallon of water) in some of the bath water and add the resulting solution to the remainder of the water. This proportion will make, approximately, a one per cent. solution.

Prepare a **sodium bicarbonate** bath in the same manner as the boric acid, the strength commonly used is about eight ounces of soda to every gallon of water.

For a **bran bath** put between two and three pounds of bran in a bag made of doubled cheesecloth and immerse this in the hot-bath water. Let it remain

in the water, moving it around from time to time until the water is of a milky color and the required temperature.

For a **sulphur bath** dissolve from one to two ounces of sulphurated potash (known also as liver of sulphur) in hot water and add this to the bath water.

Mustard baths are used chiefly in the treatment of children in convulsions or as foot baths. The mustard is to be either made into a smooth paste with cold water before being added to the bath water or else tied in gauze and this moved about in the bath water until the mustard is dissolved. The object being to avoid having lumps of mustard undissolved in the water as these are likely to adhere to the patient's skin and cause blisters. If the temperature of the water is below 105° F. use one tablespoonful of mustard for every gallon of water, if the temperature is higher than this use somewhat more mustard, about one and a quarter tablespoonfuls for children and from this amount to two tablespoonfuls (depending upon the temperature of the water and the apparent degree of delicacy of the patient's skin) for foot baths for adults.

For **sea salt** baths dissolve about ten pounds of the salt in a tub half full of water.

The amounts of the special salts (as the artificial Nauheim) and the method of preparing them for use are stated on the packages in which the salts are bought and as these vary considerably it is hardly worth while giving directions here. Some preparations of this kind will destroy the pipes ordinarily used in house plumbing and, therefore, can be used only in places where special pipes have been installed.

Light Baths

The use of light in the treatment of disease is known as *heliotherapy*.

Before considering the therapeutics of light, it will be well to recall a few facts regarding what is known as *the ether*, for, as a rule, other ether forces, in addition to its manifestation known as *light* are made use of in heliotherapy.

It will be remembered that in order to account for the transmission of the sun's light and heat through space and certain other phenomena of nature, scientist have concluded that there must be a tenuous, though invisible, medium, that they have called *the ether*, permeating space and that this, by means of the molecular motion known as *heat*, is thrown into a wave-like movement that has a velocity of 180,000 miles per second. These waves, when produced by very hot bodies, like the sun, are of exceedingly different lengths, some of them being miles long and others only the fraction of a millimeter.

These waves, generated by heat, will, though not hot themselves, beget heat in matter upon which they impinge, because they increase molecular motion in matter upon which they strike and heat is molecular motion. In addition to their heating effects, the longest waves are capable of producing electrical phenomena and are therefore known as *electrical waves;* some of the waves shorter than the electrical waves, as far as known, give rise only to heat and are thus called *heat waves;* waves between .0007 and .0004 of a millimeter stimulate the optic nerve and are known as *light waves;* and still shorter ones than these induce chemical reaction in various substances and

are consequently known as actinic or chemical rays. Also they are called ultra-violet rays because they are shorter than the shortest of the light rays and these when separated from light waves of other lengths, give rise to a sensation of violet when they stimulate the optic nerve and are therefore said to be of a violet color.[1] It is only, it will be remembered, when light waves of all lengths are present together that we have the usual sunlight hue, for it has been found that when the light waves of different lengths are separated those

.0007 mm.	are	red
.0006 "	"	orange
.00058 "	"	yellow
.00053 "	"	green
.00047 "	"	blue
.0004 "	"	violet

Another point that it is essential to recall in order to understand some procedures in the use of light in therapeutics is that ether waves may be absorbed by matter or be reflected from it, or they may pass through it, but those of different lengths pass with different degrees of facility through dissimilar substances. Coloring matter is a very potent factor in determining the degree of absorption, reflection, or passage of ether waves,were this not so dyes would not produce different colors. This property of pigment is of value in helio-therapy because colored glass can be put between the patient and the light when it is desired to exclude certain rays; for red glass allows free passage of heat

[1] Students who have not studied physics should read the sections on the nature of light, color, and heat in a textbook of physics.

waves, but inhibits the passage of chemical rays[1] and, though to a less extent, light rays; yellow and green glass allow only light waves to pass readily, but do not shut out either heat or actinic rays entirely; blue and violet give freest passage to the short chemical rays and shut out the heat rays. However, even chemical rays will induce molecular motion and, consequently, heat in matter upon which they strike, though, as their heating effect is so much less than that of the longer ways they are sometimes spoken of as the *cold waves*. To repeat, when light is credited with the stimulant effects obtained in heliotherapy, just as when it is claimed to be the source of energy promoting the growth of plants, the term is used, not in its restricted sense, but to represent the different forms of vital energy that heat sets in motion in the ether.

Electric lights, for obvious reasons, are made use of to a greater extent than sunlight in heliotherapy. That these will, though, of course, to a much lesser degree, produce similar forms of energy to the sunlight is shown by fact that the growth of plants can be hastened by subjecting them to the influence of powerful electric lights during the night. It is, however, only by the use of special devices such as what is known as the *quartz burner*, which is used in an apparatus called the *Alpine Sun Lamp* that any amount of chemical rays can be secured for therapeutic purposes with electric lamps.

The purposes for which electric light baths are used in therapeutics are: (1) The effects of heat, see

[1] What is known as *sunburn* is not in reality a burn, but a form of erythema due to the chemical rays. In some treatments, however, these rays are thought to be the most essential ones.

page 222; (2) the stimulation of nutrition, which is promoted by the increased molecular motion induced by the rays striking upon the body; (3) the promotion of tissue growth in open wounds; (4) the disinfection of wounds.

The details of procedure depend upon the nature of the apparatus available, the patient's condition and whether or not diaphoresis is to be induced.

The appliance commonly used for giving general electric-light baths is some form of box-like cabinet which surrounds the body, except the head, and is supplied with electric lights. In some types the patient sits and in others lies nude, exposed to the rays. A bath blanket, which is put around the patient when she is undressed, is spread out over the chair or, if the patient is recumbent, the floor of the cabinct and, at the conclusion of the bath, before the door is opened, the patient draws this around herself or, if she is unable to do so, the nurse, opening the door to the slightest necessary extent, does so for her.

There are also cabinets, which can be put over the patient on a bed, that are similar to those used for giving hot-air baths in bed, with the exception that they are supplied with electric bulbs, instead of an opening for the admission of hot air. Also a cabinet can be improvised by using the same substitutes as for the hot-air bath, excepting the heating apparatus and shields, and in lieu of these, a string of electric lights, such as is used for lighting Christmas trees, but of somewhat higher power, can be used and, in order to throw the rays upon the body, metal reflectors should be placed over the lights; these can be the ordinary reflectors used over electric light bulbs or pieces of tin or zinc bent over the cradle above the lights.

When the bath is given to promote diaphoresis, if a stationary cabinet is used, the patient, after leaving it, lies on a bed or cot that has been prepared as for the bath pack (page 232) and receives similar treatment. If the bath is given in bed the treatment during and after the bath is the same as for the hot-air bath in bed with the following exceptions:

(1) Remove the blanket covering the patient. This need not necessarily be taken from the bed, in fact it is better, after covering the cradles or getting the cabinet in position, to put your hand under and draw the blanket to one side, for you will then be able to cover the patient with less exposure when the time comes to remove the cabinet, etc. The reason for uncovering the patient is to expose the body to the rays produced by the heat of the lamps.

(2) As high a temperature is not prescribed, as a rule, for a light as for a hot-air bath, because, in the former, the body temperature is likely to be increased by the molecular motion that is caused by the rays striking upon the body[1] as well as by the inhibition of heat elimination and other conditions caused by the heated air. Temperatures very commonly prescribed are between 100° and 120° F.

When the bath is given for other purposes than to produce sweating means are taken to prevent any

[1] People who have ascended to the summit of high mountains, where, as the air is rarefied and contains little moisture and there is dearth of vegetation, there is little to shield them from the direct rays of the sun, have suffered intensely from the heat produced within their bodies by the impinging rays, even when the surrounding air was intensely cold and the ground was covered with snow.

unavoidable rise of the temperature of the air surrounding the body, and, therefore, there are the following differences in procedure:

1. Do not bring the blankets, etc., that are under the patient up over the cabinet nor cover it and, if cradles are used, cover these only with sheets as described on page 246.

2. The duration of such a bath is generally from one half to one hour.

3. When the bath is over, rub the patient at once with alcohol, keeping the bath blanket[1] over her as you do so, and then remove (1) the blanket, etc., protecting the bed and (2) the blanket covering the patient, drawing up the bed covers at the same time in the usual manner.

Even when the treatment is given in this manner keep an ice-cap on the patient's head and, unless contraindicated, give about two ounces of water every fifteen or twenty minutes or oftener if desired, because diaphoresis is increased even though it is not as pronounced as when the surrounding air is heated and, usually, is not apparent, the air being sufficiently heated to hasten evaporation. The fact that the patient is thirsty during and following treatments is proof of the loss of water from the body.

To derive the fullest benefit from such treatments, a patient, even though not confined to bed, should remain quiet for at least an hour after a bath.

[1] A bath blanket is put over the patient in the usual manner before preparing her for the bath, it is moved to one side when the bath covers are in place and drawn over her before they are removed.

Local Electric-Light Baths

Both electric lights and sunlight are now very frequently used in the treatment of indolent ulcers and infected wounds. The cabinets provided for this purpose are used in the same manner as the local hot-air cabinets.

A good and very easily improvised substitute can be arranged as follows:

Put a cradle or a support such as described on page 96 over the part to be treated and from this suspend a light or lights, covered with reflectors, so that the rays will be diverted directly into the wound. Remove all covering, including dressing, from the wound. Cover the cradle with a sterile sheet or sterile towels.

Sun Baths

Equipment: 1. A comfortable cot or couch provided with sufficient pillows to make the patient comfortable.

2. Colored eyeglasses or an eyeshade and, in hot weather, an umbrella.

3. A loin binder and safety pins.

4. A bath blanket.

5. A screen.

Put the couch where the sun will shine directly upon it and put the screen around it.

Method: Place the couch where the sun will shine directly upon it and put the screen around it. Undress the patient under cover of the bath blanket, pin the binder around her pelvis. Leave the blanket under her with the sides free so that she will feel

that she can draw them over her if necessary, as otherwise she is likely to object to lying exposed.

Put on the eyeglasses or shade and, if the day is hot, adjust the umbrella so that it will shield the head; if necessary, tie the umbrella so that it will not be blown out of place.

Take measures to prevent the patient being disturbed.

It is said that to get the greatest possible benefit from sunlight baths, they must be taken on high mountains, under a clear sky, because the vapor in the atmosphere, which is present in largest amounts near sea-level, absorbs the short actinic (ultra-violet) rays and these, in many conditions, are the most important rays.

CHAPTER VII

Preparations for Examinations and Treatments

Preparation of patients for general physical examinations. Preparation of patients, including the restraint of children, for examinations of the ear, eye, nose, and throat. Positions and preparation of patients for gynecological examinations. Preparation of nurses' hands and the patients' skin for treatments requiring aseptic precautions. Preparation of treatment-trays and emergency treatment-bundles. Preparation of specimens, smears, etc., for examination.

Demonstration 52

Preparation of Patients for General Physical Examinations[1]

Requisites: 1. A shoulder wrap.
2. An ausculating towel.
3. A hand towel.
4. A tape measure.
5. A hand mirror.
6. Tongue depressors (wooden).

[1] A common method of carrying out this and the demonstration following is for a head nurse who knows the methods of the doctors connected with the hospital *to be doctor* and the instructor to demonstrate the nurse's duties. The large and small *demonstration dolls* will answer fairly well for subjects for Demonstrations 52 and 54, but, if possible, it is well to have a child for the procedures in Demonstration 53.

7. A package of small pledgets of gauze (these are sometimes needed to hold out the tongue).

8. A small bag to receive used depressors, etc.[1]

9. A doctor's order book, with a fountain pen or pencil attached.

10. Hot water, etc., for the doctor's hands.

Important points to remember when preparing patients for physical examinations and treatments of any kind are:

1. That the part to be examined or treated must be exposed as much as, but no more than, necessary.

2. That it is necessary to work quickly.

3. To be sure that everything likely to be required is at hand.

4. For many examinations and treatments the patient's position is of the utmost importance and thus strict attention should be paid to all details taught in this connection.

5. A good light is essential for the illumination of cavities.

6. Quiet surroundings are essential when ausculatory examinations are being made.

Procedure for preparation of patient: If the patient is conscious tell her something of the reason for the examination and what the physician will want her to do. Ask her to lie or sit (as required) unless otherwise asked, perfectly straight, with her arms at rest by her sides, for the doctor usually wishes to see if the contour of both sides of the body is the same.

Loosen the upper bed covers at the foot of the bed.

Turn the lower edge of the spread back under the blankets and arrange them so that they can be quickly

[1] In some hospitals articles 2 to 8 are kept in an enamel box or basket and taken to the bedside in this.

folded upward above the knees when the doctor is ready without disturbing the sheet.

Cover the legs and thighs with the sides of the sheet, but have the central portion gathered loosely between these parts.

Unbutton the nightgown and take the patient's arms out of the sleeves, but let the gown remain in place. If it is a closed one make sure that it can be slipped down from the chest easily; if not, take it off and lay it over the chest and arms.

The nurse's duties during an examination are so dependent upon the methods of the physician that no definite rules of procedure can be given, but common requirements are about as follows:

For examination of the chest, while the doctor is using the stethoscope, move the nightgown so as to expose the chest, as much as, and where, he requires it exposed and cover the part as soon as it has been examined. If he wishes to listen to the chest sounds without the stethoscope, move the gown down and at the same time replace it with the ausculating towel; hold a folded hand towel in front of, but away from, the patient's mouth. If the posterior chest is to be examined, cover the anterior portion with the nightgown and either turn the patient as nearly prone as possible or raise her to a sitting position, according to her condition and the physician's wishes. If she is to sit up, button her gown around her neck so that it will remain covering the front of her chest and, as soon as you have raised her, draw a pillow down against the lower part of her back, cover the upper portion and the back of her head with the ausculating towel, and put the side that was against the patient previously next to her again, for the physician will

not want to put his face against the side that has been next the patient. If the stethoscope is used move the ausculating towel as required.

For examination of the abdomen: Have the patient lie perfectly straight, with her arms passively by her sides. Leave the nightgown covering the chest and, if the air is cold, put a shoulder wrap over this. Place a towel over the pubes and turn the covers down below the abdomen. It will probably be necessary to flex the patient's knees during the examination and, when doing this, hold the top fold of the covers so that there will be no unnecessary exposure.

For examination of the legs, fold back the spread and blankets to the upper part of the thighs. If, as is frequently the case, the physician wishes to compare the legs gather the sides of the sheet, which are covering the legs, between them, if he does not, expose only the one that he wishes to inspect.

If the throat is to be inspected, hand the tongue depressor to the examiner on a towel, and, at the conclusion of the examination, hold out a paper bag to receive it.

To prepare a small child for examination of the chest: Put a crib blanket around the child with the opening at one side. Wrap it securely about the legs, but leave it loose at the top so that the chest can be exposed the minute the physician is ready. If the child is left on the bed, hold its hands loosely above its head, but a small child can usually be kept quieter if it is held on the lap for examination of the anterior chest and in the arms for the posterior. For the former purpose, sit opposite the examiner with the child across your knees, its head falling slightly backward. Keep one hand upon the child's legs and,

with the other, hold the child's arms above its head. For examination of the posterior chest, stand and hold the child with its chest above yours; have one of your arms across its thighs, just under the buttocks, and, with your free hand, hold its head slightly bent upon your shoulder.

Demonstration 53

Preparation of Patient, Including the Restraint of Children, for Examination and Treatment of the Ear, Eye, Nose, Throat

Requisites: 1. A sheet or blanket for restraining the child. If the latter is small, a crib sheet will answer, otherwise, a large one will be needed.

2. Head mirror.

3. Light.

4. Ear and nasal specula.[1]

5. Rhinoscope and laryngeal mirrors.[1]

6. Alcohol lamp and matches, or hot water and towel, or other source of heat with which to warm the rhinoscope and laryngeal mirrors and thus avoid condensation of moisture upon their surfaces during use.

7. Tongue depressors.

8. Gauze compresses suitable for holding out the tongue, if necessary, during examination of the throat.

9. Hand towels.

[1] Specula and mirrors provided for these purposes are of different sizes and the size to be chosen must, of course, depend upon the size of the patient.

The specula are sterilized before use by boiling them for five minutes and the mirrors by immersion in carbolic 1:20, or other disinfectant that will not injure their metal portion, and, before use, they must be well rinsed in sterile water.

Procedure when wrapping a child in a sheet[1] for restraint[2]: Place the sheet cornerwise on one side of the bed, turn back enough of its top corner to obtain a straight fold sufficiently long to bring around the child's neck and obliquely across its chest. Lift or draw the child to the center of the blanket; have the top fold about two inches above its neck. Turn

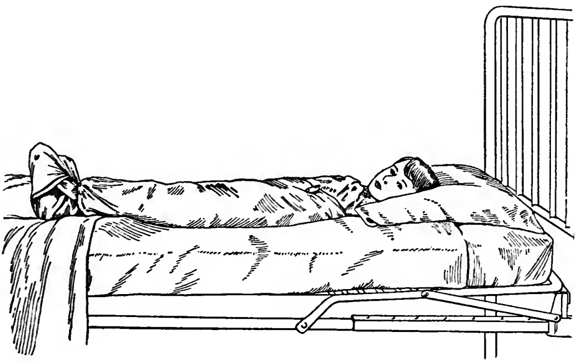

Fig 27. Restraint of child with sheet.

the bottom corner of the sheet up over the child's legs. Bring the upper fold around the neck over the shoulders and, obliquely, across the chest (it must fit snugly around the neck); wrap first one side and then the other around the child as tightly as possible without hurting it. As the sides of the sheet are brought forward there will be a fold between them and the portions coming over the shoulders;

[1] If the room is at all cold, especially if the child is undressed, a blanket should be used instead of a sheet.

[2] Do not let the child realize that it is being restrained. Give it the impression that the wrapping is for warmth only and, if it is old enough, try to divert its attention by talking about something that it is interested in.

bring these folds just above the elbows as they will then form a band that will help to keep the child from bending its arms and thus getting them free.

Position of the patient for examination of the ear (otoscopy): Seat the patient with the ear that is to be examined turned toward the examiner and on a level with the latter's eyes. If reflected light[1] is used, place the lamp just behind the patient, on the right side, a little above the level of the ear. If direct lighting is used place the light so that it will fall directly into the ear.

If the patient is a child, hold it on your knee, restrained, if necessary, with a sheet, as described page 273, with its legs between yours and one of yours crossed upon the other so as to securely imprison the child's; hold the child's head against your chest with its ear in the position described in the preceding paragraph. Keep your free arm around its body, including its arms.

Position of patient for examination of the eye: The patient is to sit facing the physician. A child is best held in the lap, restrained if necessary, either as described page 273 or page 275, but a baby is usually wrapped as described page 273 and held in the nurse's lap with its head on the physician's knees.

Position of patient for examination of the nose (rhinoscopy) and throat (laryngoscopy)[2]: The patient

[1] Light that will fall upon the head-mirror worn by the examiner and be reflected from it into the patient's ear or whatever cavity is being inspected.

[2] As the throat is nearly always examined when there are abnormal nasal conditions, the equipment for both examinations should always be provided for inspection of the nasal cavities. This will include all the articles mentioned on page 272 except the ear speculum.

sits facing the examiner with the head tilted slightly backward. If a reflected light is used, place it a little behind the patient, at the right, and on a level with the ear.

If the patient is a small child, hold her on your lap, wrapped, if necessary, as described on page 273, with her legs held between yours as in Fig. 28. Hold the child's head tilted slightly backward, against your chest, and, with your free hand, restrain its arms if required; this can be done by passing your free arm in front of one of the child's arms and behind her back and grasping her other arm with your hand as in Fig. 28. Or, according to another method of restraint that is very commonly used, pass one of your arms under and around the upper part of each of the child's arms and hold its head by placing one of your hands on each side.

Fig. 28. Method of restraining child.

Demonstration 54

Position and Preparation of Patients for Rectal and Gynecological[1] Examinations and Treatments

Requisites: 1. An ordinary sheet and a fenestrated sheet.

[1] Derived from two Greek words signifying a *discourse of women.*

2. Four towels.

3. A Kelly pad[1] and empty pail.

4. A tray containing the articles required for a simple vaginal examination, viz., (a) a rubber glove, (b) a small dressing glass or bowl containing a lubricant (a solution of lysol, about four per cent., is often used for this purpose), (c) a bi-valve[2] and a Sims speculum,[2] (d) a uterine sound,[2] (e) a sponge holder,[2] (f) a small bundle of cotton or gauze sponges, (g) a paper bag to receive soiled sponges.

5. A tray containing articles necessary for simple treatments, viz., the same as for examinations and, in addition, (a) uterine and dressing forceps, (b) tenacula, single and double, (c) scissors, (d) tampons or gauze packing, (e) lotion or disinfectant.

6. Safety pins.

The positions commonly used in gynecological examinations are as follow:

1. **The dorsal or supine position,** see page 68.

2. **The dorsal recumbent position** in which the patient lies with her knees flexed and separated, the soles of her feet on the bed or, if she is on a table adapted for gynecological examinations, the extensions provided for the feet. Frequently when there is no such table to be had or the patient is too ill to move to one, it will be necessary to turn her in bed so that she will lie across the latter and rest her feet on two stools or chairs placed at the side of the bed. Space enough for a chair for the examiner must be

[1] In actual practice it is not necessary to provide a Kelly pad and pail when it is known positively that there is to be no treatment given.

[2] These instruments should be sterilized, before and after use, by boiling them for five minutes in soda solution.

left between these two supports and, if possible, a board, the length of the width of the bed and about two feet wide, should be put across the bed under the springs, to prevent the mattress sagging under the patient. When the latter is placed either as just described or on a table, the buttocks must come to the extreme edge, or even slightly beyond the edge, of the table or bed.

3. **Dorsal lithotomy or dorso-sacral position** in which the patient lies on her back with her thighs flexed on the abdomen and her legs flexed at right angles with the thighs and held in position with a crutch or, if this cannot be obtained, a sheet folded diagonally and passed under her knees and either under her neck or else one end under her back and the other across her chest, and, in either case, tied over one shoulder.

4. **The Sims or left lateral position** in which the patient lies on her left side, somewhat obliquely across the table or bed, with the left side of her face and her left shoulder and breast resting upon a flat pillow; her left arm lying passively behind her back and her right one loosely at her side; her thighs flexed, the right one more than the left. The buttocks should be at the extreme edge of the table and, as a rule, one of the table extensions is drawn out to support the feet.

5. **The knee-chest position** in which the patient kneels, her knees slightly separated, her chest and one side of her head resting on a pillow placed on a level with her knees; her elbows bent and her fore-arms resting on the bed or examination table.

6. **The standing or erect position** in which the patient stands with her knees separated about ten

inches, one foot on the floor, the other on a low stool, and her hand resting on a table or other support.

7. **The Trendelenberg position**[1] in which the patient lies supine on an inclined plane, her head lower than her abdomen, her knees flexed, and her legs resting against and, if she is under the influence of an anesthetic, tied to a support. Operating tables have special supports for this position; for an operation in the home, if such a table cannot be secured, a chair can be placed with the front edge of the seat and that of the top of the back resting on one end of a narrow table; the back of the chair will thus serve as the support for the legs.

The procedure of this demonstration can be only imperfectly shown with the demonstration doll, but enough idea of the important points can be gained to make it possible to learn all further technique by careful observation when assisting more experienced nurses with these procedures in the wards, etc. It can be readily appreciated that awkwardness and mistakes in technique during examinations and treatments of this nature are likely to cause much embarrassment and, therefore, it is most important that the essentials be understood, remembered, and always carried out.

Preparation for a patient for a vaginal examination: This must necessarily differ somewhat according to circumstances. When possible, if the patient is at all constipated, she is given a cathartic or an enema some time previous to the examination, because distention of the lower bowel with feces may interfere with the

[1] Though this position is not used for examinations it is mentioned here as it is used for so many abdominal operations connected with gynecology.

inspection of adjacent genital organs. Sometimes a vaginal douche is also given, but this must never be done without knowing the examiner's wishes, for the physician frequently wishes to see existing conditions before they have been changed by a douche. It is, however, always necessary to observe if the surrounding parts are clean while placing a patient in position and, if not, to make them so.

When the patient is staying in the hospital her clothing for the examination, unless she remains in bed, usually consists of a nightgown, wrapper, and laparotomy stockings. In the home and, sometimes, in the hospital, ordinary stockings and open drawers are substituted for the laparotomy stockings. When the patient remains in bed, the wrapper is omitted and the upper part of her body is covered with a blanket or shoulder wrap. A patient coming to the hospital or dispensary, etc., for the examination, usually retains the clothing she is wearing with the exception of her corsets and dress skirt, but all waist bands must be unfastened and, if the clothing is at all soiled, towels must be pinned around the portions surrounding the parts to be examined before the sheet is draped about the patient.

Particularly essential points to observe when arranging the sheet about a patient in any of the positions just described are: That the parts to be examined must be exposed as much as necessary, but not more, and that, therefore (1), the sheet used to prevent exposure must be so arranged that it will be sufficiently well secured to prevent it slipping, especially around the parts being examined, and thus getting in the physician's way or allowing of unnecessary exposure, (2) the sheet must be so draped that

the outline of the patient's figure is not discernible, and (3) even the parts that are to be exposed are to be covered until the physician needs the covering removed, and this must be so arranged that it can be thrown back without disarranging any other portion of the drape.

Procedure when arranging a patient for a vaginal examination: Have the patient lie on the table or across the bed, cover her abdomen and legs with a sheet, placing this lengthwise across her.

Arrange her in position.

Fold her nightgown or skirts up above the pubes in front and the buttocks behind, arranging them very loosely over the abdomen so that they can be moved upward quickly if the physician wishes to examine the latter. Put a towel around the lower border of the folded clothes.

If treatment is to be given, put the Kelly pad (covered with a dressing towel where the patient will rest upon it), in position to catch drainage.

Proceed to drape the sheet around the patient. Methods in common use are as follows:

For the dorsal positions:

Method 1. Gather the center of the lower edge of the sheet up sufficiently far to expose the vulva, twist one of the lower corners around each foot, but allow the sides to hang like curtains on either side of the legs. Place a towel on the abdomen with one end screening the vulva. Turn this end up if necessary when the examiner is ready.

Method 2. Proceed as for Method 1, but retain the sheet in place by tucking the upper corners under the patient's buttocks and back, instead of twisting the lower ones around her feet, and leave

the latter hanging so that there will be, as it were, a curtain on both sides of her legs and feet.

Method 3. This method requires a fenestrated sheet. Place this cornerwise over the patient with the opening over the vulva; turn back the lower point and tuck it under the buttocks, twist the two side corners securely around the feet, but allow the sheet to hang on both sides of the legs; bring the upper corner of the sheet well up over the abdomen and turn back its upper portion so that the point will fall over the vulva. This is raised when the examiner is ready.

Arrangement of the sheet for Sims's position:

Method 1. Bring one half the length of the sheet behind and around the patient. Tuck the lower edge of the half falling over her thighs and legs and the continuation of this, which forms the upper border of the part brought around the patient, between her thighs and legs, leaving it loose around the vulva. Avoid unnecessary exposure by placing a towel in such position that it will cover the exposed portion.

Method 2. A fenestrated sheet is used for this method. Arrange the sheet so that its opening will expose the vulva. Tuck one corner under the patient's back and another under her legs. Cover the vulva until exposure is necessary with either a corner of the sheet or of a towel placed on the upper part of the thighs.

To drape a patient in the knee-chest position gather the lower ends of the sheet up above the parts to be examined, pin the fold to the patient's wrapper or nightgown in order to hold it in place, and pin the sides of the sheet on the thighs and legs. Place a towel where it will screen the exposed parts until the physician is ready.

If a fenestrated sheet is used, place the aperture over the part to be exposed and cover this with a towel.

When the patient is in the standing position, pin the sheet around her waist like a skirt with the sides overlapping, the under edge being directly in front and the upper one almost at the side.

An important item in the assistance often required of the nurse during examinations and treatments when the patient is in the Sims position is to hold the Sims speculum. To do this, stand on the left side of the patient, put your left arm across her hip, and separate the buttocks with your left hand. After the doctor has inserted the speculum, grasp its handle with your right hand and hold it so that your thumb and fingers are on the inner side—*i. e.*, next to the patient.

Demonstration 55

Disinfection of the Hands and of the Patient's Skin in Preparation for Treatments

Requisites—For the preparation of the hands:

1. Hot and cold water.
2. Nail-brushes and orange-sticks in a disinfectant.
3. The disinfectant or disinfectants used for the disinfection of hands in the hospital.

For the disinfection of the patient's skin:

1. A treatment preparation tray. This usually holds: three wide-mouthed, glass-stoppered, one-ounce bottles containing (a) iodine, (b) alcohol, (c) ether; two small covered glass jars containing (a) sterile gauze sponges, (b) sterile applicators made of wooden toothpicks covered at one end with absorbent cotton; a deep covered jar or wide-mouthed bottle

containing 95% alcohol and a pair of sterile forceps; a small receptacle for used sponges and applicators.

2. An operation preparation tray. This generally holds: two pitchers[1] with a capacity of between one and two pints containing hot (120° F.) sterile water; four bowls[1] that will hold about half a pint; two bowls or glasses[1] that will hold about two ounces (for the alcohol and ether); a bowl containing a disinfectant, nail-brush, and orange-stick; bottles of soft soap, ether, and alcohol, and other disinfectant if used; packages of sterile towels, compresses, sponges, and rubber gloves; a jar containing alcohol and a pair of sterile forceps and sterile safety pins; a dressing rubber and two dressing towels—these need not be sterile; a bandage and binder, a razor or a depilatory paste.

3. A Kelly pad and pail.

Disinfection of the Skin

The skin, on account of its multitudinous ducts and the excretions and dried epithelium that collect upon its surface, affords a particularly favorable soil for bacteria and, as it is impossible to expose it to a sufficiently high degree of heat or for a long enough time to a disinfectant to kill bacteria, it is quite impossible to render it actually sterile. The imperviousness of the skin to disinfectants is still another difficulty in sterilizing it. Iodine and, some authorities claim, potassium permanganate will penetrate

[1] These are either sterilized before use by boiling for five minutes, or else, after use, they are boiled, dried with a sterile towel, piled together and rolled in a sterile towel, sterile rubber gloves being worn while drying and wrapping them.

to a greater extent than other disinfectants, but even these, especially the latter, cannot be depended upon to reach the deeper layers.

The degree of disinfection that is absolutely required by the skin, both that of the patient's at the area of treatment and of the worker's hands, must naturally depend upon the nature of the treatment and the degree to which the deeper tissues are to be exposed to infection. When the treatment simply consists of the introduction of a fine sharp needle and subsequent injection of a sterile non-irritating solution which will not involve any injury to tissue cells, all that is usually necessary is the removal of soil from the skin at the point of injection, but, if large needles are used or the fluid to be introduced is irritating, extra care is necessary because any injury to tissue cells lessens their powers of self-defense; if an incision is to be made the skin ducts must be rid, as far as possible, of the germs and excretions they harbor.

The soil on the skin that is due to excretions from its glands is of a fatty nature and thus it is most easily removed by ether, benzine, and hot water and soap. Alcohol, between 50% and 70%, has some solvent effect upon fat and is a particularly good skin detergent also it is a disinfectant, therefore, it is very commonly used to prepare the skin for superficial hypodermic injections. As, however, alcohol does not penetrate the skin, iodine is generally used when large needles are employed or an incision is to be made and, if the skin is at all dirty, it is washed, if possible, with ether, benzine, or alcohol some time before the iodine is used. Moisture on the skin interferes with the penetrating property of the iodine

and, therefore, when it is used as a disinfectant the skin is only washed with water (which does not evaporate quickly like ether), when the washing can be done some hours before the treatment or operation, but, as previously stated, if a deep incision is to be made it is desirable to rid the ducts of the skin glands, as far as possible, of excretions and bacteria, and the best way to do this is to render the glands active and soften the dried epidermis by the use of hot water. It can be appreciated that to be effectual this treatment must be continued for some time and must be followed by friction to remove the material excreted as well as the softened epidermis and bacteria from the surface of the skin, and the friction must be as energetic as possible without irritating the skin. Any roughening of the skin is to be avoided as it interferes with its proper cleansing.

As previously stated, the same considerations apply to the cleansing of the worker's hands as to the patient's skin. Thus an ordinary cleansing of the hands is generally all that is necessary before preparing and giving a simple hypodermic injection, but when preparing for treatments that require the use of many sterile articles or to assist or give such treatments further preparation of the hands, such as is described on pages 287 to 288 is essential. Method 2 is generally considered a sufficient preparation, especially when sterile gloves are worn, for the arrangement of treatment trays and for assisting with or giving treatments that do not necessitate touching anything that will come in contact with a wound. It is to be realized, however, that even Method 1 will not render the hands sterile, that even sterilized gloves are not entirely satisfactory, and that therefore **instru-**

ments and dressings are to be handled as far as possible with sterile forceps.

Important points to remember in connection with the disinfection of the hands:

1. The hands must be kept in good condition by (a) a sufficiently frequent use of lubricants; (b) handling soiled material, such as used dressings, with forceps.

2. Before and while disinfecting the hands, the cuticle under the skin is to be rubbed, even when it looks absolutely clean. A flat-edged orange-stick is much better than a metal file for this purpose as it is less likely to roughen the cuticle.

3. When disinfecting the hands there is to be no guessing as to the time, it is to be ascertained by the clock.

4. Use as hot water as possible for the first part of the cleansing and cold for the last in order to check the activity of the glands so that the surface of the skin will not become covered with their excretion after it has been disinfected.

5. Do the last part of the cleansing under running water so that all soiled matter will be permanently washed off the skin.

6. Rinse the soap from the skin thoroughly before using the disinfectant. This is especially important when bichlorid of mercury is used, because the soap combines with the acid or salt that is added to bichlorid to render it more soluble and lessen its tendency to combine with protein material and, if therefore, the salt or acid (whichever has been used) is removed, the disinfecting power of the mercury is lessened and it is much more irritating to the skin.

Procedure in disinfecting the hands:

Method 1. See that the finger nails are sufficiently short. Add some liquid or soft soap to a basin, three quarters full, of hot water; immerse the hands and arms to above the elbows in this and allow them to remain for two minutes. Take a sterilized nail-brush[1] and scrub thoroughly every part of the hands and arms to well above the elbows (including the finger nails) for five minutes. Clean the cuticle under and around the nails with an orange-stick. Scrub the hands and arms under running water[2] for three minutes, using cold water for the last half of the time. Be sure that all soap is removed and then use the disinfectant that the surgeon desires. Rub this into the skin.

Disinfectants for the hands that are very commonly used after preparing them as above are:

1. Chlorid of lime and carbonate of soda. To use these, take equal parts of each and make them into a paste with water, rub this on the skin (as soon as the mixture is wet, chlorin gas, which is a good disinfectant, is liberated). Wash off the paste with sterile water and then immerse the hands and arms in bichlorid of mercury 1:2000. Dry the parts with a sterile towel.[3]

2. Alcohol 95%. After the mechanical cleansing, dry the parts with a sterile towel and then bathe and

[1] Nail-brushes and orange-sticks used for this purpose are boiled each day or, sometimes in the operating-room, after each operation, for five minutes and then put into a disinfectant. They are rinsed after use and at once returned to the disinfectant.

[2] When this cannot be done under running water, *i. e.*, under the faucet, the water in the basin should be changed.

[3] When wet rubber gloves are to be put on the drying is omitted.

scrub them with alcohol, using a sterile gauze compress for the purpose. Dry the skin with a sterile towel.

3. Harrington's solution.[1] Immerse the parts in this for one minute and then rub them with alcohol and dry them with a sterile towel.

4. Bichlorid of mercury and potassium permanganate solution. Immerse the hands and arms in hot bichlorid of mercury 1:1000 for two minutes and then in a potassium permanganate solution until the skin is deeply colored. This is removed after operation by washing with oxalic acid solution followed by ammonia water to neutralize the effect of the oxalic acid. This method is preferred by some surgeons because the permanganate forms a thin film over the skin and thus, it is thought, may prevent the egress of bacteria from the deeper parts of the skin after disinfection.

5. Iodine. Paint the skin with the iodine. If 7% is used allow it to dry and then wash it off with alcohol. If 3% is used do not remove it until after the operation.

Method 2. Scrub the hands and forearms to above the elbows with hot water and soap for two minutes; clean the nails and the cuticle around them; repeat the scrubbing for another minute, using fresh soap and water; rinse and scrub the parts in cold, preferably running, water for one minute. Scrub them with the disinfectant (using a sterilized gauze compress or brush for the purpose) for at least one minute.

Bichlorid of mercury 1:1000 is a very commonly

[1]

Corrosive sublimate	0.8 gm.
Alcohol 94%	640.0 c.c.
Hydrochloric acid	60.0 "
Water	300.0 "

used disinfectant following this shorter method of cleansing the hands.

To put on rubber gloves properly requires practice and thus the pupils should drill doing this with dry and with wet gloves until they can put them on as quickly as it is possible to do so without touching their outer surface.

Points to be considered are: always choose gloves that fit properly, for, if they are too small, they are hard to put on, and they, by their pressure, interfere with the tactile sense and cause discomfort; if they are too large they prevent dexterity of manipulation.

While putting on sterile gloves, hold your hands away from your body so that the gloves will not come in contact with anything unsterile.

If the gloves are to be put on dry, arrange the wrapper in which they were sterilized so that it can be opened without touching the outside before you wash your hands.

After washing and disinfecting your hands, **if the gloves are dry**, dry your hands, slip either a finger or sterile forceps under the outer fold of the wrapper[1] and open it. Dust your hands with the sterile powder in the package (see page 16), take hold of the upper edge of the glove for the left hand, and, holding it thus, insert your hand and pull the glove into place. Put on the other glove and in doing so avoid touching your arm or hand; it will not matter so much if you

[1] Especially in the operating room, this is often done by a nurse whose duty it is to help the surgeons and "sterile nurses" adjust their sterile aprons, etc., and, if her hands are not as sterile as possible she must handle the outer and not the under surface of the wrapper.

touch the outer surface of the glove with your gloved hand. Turn back the cuffs by slipping a finger under them and raising the fold upward. If a sterile long-sleeved gown is worn the cuffs of the gloves are not turned back until this has been put on.

To put on the gloves when wet, do not dry your hands and leave some solution or sterile water in the gloves; hold your hands above a basin while you are adjusting the gloves. Do this in the same manner as when putting them on dry. When each glove is in place, empty any remaining solution from it by raising the hand and stretching the cuff of the glove—be very careful not to touch your arm with the outer surface of your glove while doing so.

Procedure in the preparation of the patient's skin for aseptic treatments and operations.—For a hypodermic injection:

Method 1. With sterile forceps, take a sterile sponge from the container, with your left hand lift the stopper from the bottle or jar containing the alcohol, dip the lower portion of the sponge into the alcohol, replace the stopper: rub the wet sponge back and forth over the proposed site of injection several times, being careful not to let the tip of the forceps touch the skin, make considerable pressure as you rub. Drop the sponge into the receptacle provided for the purpose; replace the forceps in the alcohol in which they are kept.

Method 2. To use iodine, take an applicator from the container with sterile forceps, replace the latter in the alcohol, dip the cotton of the applicator into the iodine, rub this on the skin. Let the iodine dry. If a second application is necessary take a fresh applicator, do not put a used one into the iodine. If a

large surface is to be painted, sterile sponges, held with forceps, can be used, instead of applicators. An important point to remember in connection with the use of iodine is that, if it runs between folds of skin or under parts where it will not dry readily, it is likely to blister, thus, this must be prevented, or, if the iodine is needed in such places, they must be exposed to the air until they dry.

Method 3. This method is used when an incision is to be made and there is not time to allow the skin to dry if water is used. Shave the skin, if necessary, without the use of soap. Wash it with benzine or ether in the same manner as alcohol is used in Method 1. Cover it with a sterile compress and leave it thus until about two minutes before the surgeon is ready then paint the skin with iodine,

Method 4. Have the operation preparation tray and other articles mentioned on page 283, at hand.

Give your hands an ordinary washing with soap and water and dry them.

Remove the outer wrappers from the dressing towels, gloves, etc., or, if they each have but one, arrange it so that it can be opened without touching the outside. Prepare some hot (120° F.) soap solution in one pitcher, using enough soap to get a good lather. Pour a small amount of this into a bowl; drop from two to six sponges (according to the amount of surface to be prepared) into this.

Draw the patient to the side of the bed if necessary.

Expose the part to be prepared; if this is the abdomen, place a wrap across the patient's chest.

Protect the bedding with a Kelly pad and dressing rubbers covered with dressing towels, if much of the body is to come in contact with them.

Shave the area for operation or, if the surgeon approves, apply a depilatory paste.[1] If the latter is used spread it over the area (with a wooden or glass spatula) in a layer about an eighth of an inch thick. Leave it for five minutes. If it is used around the vulva, first apply some sterile oil to the contiguous mucous membrane (using a sterile sponge held with sterile forceps), for the paste is apt to irritate mucous membranes.

Wash the skin sufficiently to remove paste, hair, etc. Wring out a folded towel or, for a small area, a compress, in the hot soap solution, put this over the part, cover it with a folded towel.

Wash and disinfect your hands according to Method 2 and then, using a sterile towel to handle unsterile articles, pour some soap solution into a clean bowl and some hot sterile water into another, open your package of sterile sponges. Place sterile towels around the area to be prepared, if this is the rule of the hospital.[2]

Remove the towels covering the skin and scrub the latter with either a sterile brush or a sterile gauze

[1] The paste in common use is made of crystallized sodium sulphid three parts (*e. g.*, three drams) fresh unslaked lime ten parts, starch eleven parts. These ingredients are thoroughly pulverized, well mixed, and put into an absolutely dry, wide-mouthed, glass-stoppered bottle. When required as much of this as necessary is made into a paste with sterile water.

Some surgeons prefer this paste to shaving because it removes not only the hair, but, also, loose epithelium and thus it aids materially in cleansing the skin and it has some disinfectant value.

[2] Sterile towels should be used when unnecessary exposure is to be avoided, as around the pubes, but, otherwise, it is quite possible without the use of towels to prevent anything unsterile coming in contact with the area being prepared or with the articles used for the preparation.

compress and soap solution for from two to ten minutes, depending upon the extent of surface that has to be cleansed and of the incision that is to be made. For a preparation that requires more than two minutes' scrubbing change the soap solution two or three times. Take special care to clean between all folds of fat, if present, and, when preparing the abdomen, the umbilicus and around the groin.

Remove the soap and wash the area with sterile water and, when possible, pour water from the pitcher over the part. Wipe the latter with a sterile towel or compress and then cover it with a fresh one. Dry the rubber and Kelly pad, and remove them.

Pour some ether and alcohol, and other disinfectant, if used, into the bowls provided for them.

Disinfect your hands by scrubbing them vigorously with disinfectant. In some hospitals, especially when the preparation is for a large incision, it is the rule that, after the hands are disinfected, gloves be put on.

Wash the part thoroughly with (a) ether, (b) alcohol. Cover it with a sterile towel or compress and secure this in place with a bandage, binder, or safety pins as best suited to the location. If pins are used do not insert them over the prepared area.

Iodine is applied a few minutes before the incision is made.

Demonstration 56

Preparation of Treatment Trays and Bundles

Requisites:

1. Trays.

2. Towels, some of which must be arranged in the manner in which the bundles of sterile towels are kept.

3. Instruments and apparatus for a treatment requiring both sterile and unsterile articles.

4. Instruments, etc., for all the treatments for which the appliances are sterilized and kept in bundles ready for use.

The main objects of this demonstration are:

1. To show the general scheme of collecting and arranging the articles required for treatments.

2. The manner of handling sterile articles, including towels and aprons.

3. The preparation of emergency treatment bundles.

Important points to remember when preparing for treatments are:

1. Put all small articles on a tray[1] and cover them with a towel for transportation to the bedside. If the articles are sterile, the tray should be either sterilized by boiling or else washed with lysol solution, at least 1% dried, and covered with a sterile towel. Pile together in the manner that will be most convenient for carrying them to their destination all unsterile articles that are too large for the tray.

2. Never put unsterile articles on a tray with sterile ones, unless the latter are few in number and are separated by a sterile towel.

3. Arrange the articles on a tray as far as possible in the order in which they will be used.

4 Be sure that everything is in order, *e. g.*, that scissors, knives, and needles are sharp and syringes working properly.

5. Be conscientious in your aseptic technique.

[1] In some hospitals the tray is covered with a dressing towel, but in others this is only done when the articles it is to hold are sterile.

6. Be sure that you have everything required.

Considerable time can be saved when preparing for treatments by a proper system in the order of doing the work. This is especially true when some of the articles are to be sterile. It would be quite impossible to give definite rules for the order of procedure; in fact, this is so dependent upon varying circumstances that it has to be decided to some extent with every preparation. Considerations to bear in mind, however, are:

1. To collect articles that are kept in the same place at the same time.

2. Usually, one of the first steps in the preparation is: put water to heat so that it will be boiling when needed for the instruments, etc., and, if there are any glass utensils to be sterilized, put them into the cold water.

3. The instruments, especially the sharp ones, are not to remain in solution a minute longer than the time required for their sterilization,[1] therefore, if their sterilization is completed before your hands are disinfected, raise the sterilizer tray from out the water and either place it across the top of the sterilizer or on a sterile towel and cover the instruments with a sterile towel.

4. Collect and arrange all unsterile articles before you disinfect your hands.

Three very essential facts to be remembered in connection with the preparation for treatments are:

[1] How long and in what are: (a) blunt, (b) sharp instruments boiled? How are sharp instruments and fragile ones, such as are used for the eyes, sometimes sterilized instead of by boiling?

How are (a) thermometers, (b) glass syringes, (c) suction pumps, such as are used for creating a vacuum in bottles, sterilized?

1. That strict asepsis is to be maintained whenever (a) the treatment is connected with a wound of any kind; (b) when an incision or puncture is to be made; (c) when anything is to be inserted in a cavity (*e. g.*, the bladder) that contains material which will be decomposed by bacteria and give rise to substances irritating to the tissues of the organ and thus facilitate infection.

2. That efficiency in aseptic technique is attained only by constant attention and thought when preparing for, assisting with, or giving treatments until all details of procedure have become a matter of habit.

3. That glass utensils, such as catheters and syringes, often become cracked during sterilization and sharp instruments blunted and that, therefore, two of each kind should be prepared for use and a glass nozzle is never to be inserted in a body cavity such as the bladder until it is inspected.

Some of the particularly important points to remember in connection with asepsis are:

1. That to make anything sterile it must be exposed to the influence of heat or a disinfectant the length of time that tests have shown the temperature or strength or solution used require to be effectual.

2. That if a sterilized object is to remain sterile it must not come in contact with anything unsterile. To avoid this the following precautions are imperative: (a) Remove all unsterile objects from the place where you are to put the sterile ones and if there is any danger of the sterile articles coming in contact with the table and surroundings, cover them with sterile towels. (b) Wash the rim of a bottle before pouring out a solution or else discard the first of the solution that flows over it. (c) If necessary to put

down the cover of a jar containing sterile supplies or the stopper of a solution-bottle place it with its lower side or end uppermost. (d) Use sterile forceps when possible for moving sterile instruments and supplies, especially when taking the latter from their container, for the hands are never absolutely sterile and even gloves cannot be easily nor as perfectly sterilized as metal. Forceps used for this purpose are often kept, after sterilization, in alcohol 95%.[1] (e) Never touch the points of sterile instruments, but take hold of them as far as possible from the point that is to be inserted in the wound or tissues or that is to come in contact with sterile supplies. (f) If necessary to move any unsterile object after you have disinfected your hands take hold of it with a pair of sterile forceps or a sterile towel; if you use the former, resterilize before you use it for anything sterile; if you use the towel, be sure, if you use it a second time, not to touch the side that has become unsterile. (g) Be careful when unfolding sterile towels and aprons not to let the side that is to be kept sterile come in contact with anything unsterile. (The pupils should practice doing this and putting on aprons until they can do these things deftly and without touching the surface that is to be kept sterile.)

The Sterilization of Articles Used for Treatments

Instruments, needles, and catheters of all kinds are sterilized before use in the same manner as after use, as described in Chapter I.

[1] 95% alcohol is not as good a disinfectant as 70%, because it coagulates the protein on the exterior of the bacteria and thus is prevented penetrating to their vital parts, but the water in 70% causes the metal to rust.

Douche nozzles are boiled for five minutes after use, but, in some hospitals, they, after sterilization, are put into a jar[1] containing a disinfectant such as bichlorid 1:5000 and are then not boiled before use, except when the douche is given following operation on the parts douched or their surroundings, in which case, the can and tubing are also boiled.

Rubber rectal tubes and stomach tubes are boiled after, but not, as a rule, before use, but stomach tubes should be rolled in a sterile towel after sterilization, not so much with the idea of keeping them sterile as of keeping them clean. It is undesirable to boil rubber articles of this kind oftener than necessary, for doing so softens the rubber.

Aspirating bottles and other appliances used to receive from the body material that is likely to be examined for bacteria should be sterilized by boiling for five minutes before use.

Preparation of Emergency Bundles

It is a common custom in hospitals to have the instruments and dressings necessary for treatments that are likely to be given in emergencies rolled, after they have been sterilized, in sterile towels and put away in a covered container, such as a metal box that is sterilized at frequent intervals.

It can be easily appreciated that it is most important, since these things will not be sterilized again before use, to take special care in their sterilization after

[1] The jar used for this purpose is to be sterilized daily by boiling for five minutes and refilled with fresh solution. A thin layer of absorbent cotton should be kept in the bottom of the jar.

use and to keep them sterile during drying. To do this, wear dry sterile gloves, cover the table at which you work with sterile towels, and do the drying, as far as possible, under sterile towels, using sterile gauze for the purpose.[1] Drying long pieces of rubber tubing, such as are used for hypodermoclysis and intravenous infusion, is particularly difficult and it takes time. It is usually done by stretching and pressing the tubing, beginning at the center and working first toward one end and then toward the other, and wiping away moisture forced to the openings. The drying is more easily accomplished if it is begun as soon as the tubing is removed from the sterilizer. It is most important that it be done thoroughly for, if moisture is left in the tubing, the rubber in the interior will be rotted and small particles may be washed into the tissues or, if the tubing is used for an intravenous infusion, the veins. Old tubing should never be put into such bundles since it is more easily disintegrated than new.

Other important points to remember are: (1) To be sure that the instruments, etc., are in perfect order—test all syringes with sterile water before drying them. (2) Be sure that everything belonging to the outfit is included in the bundle. (3) Arrange the instruments in such order that there will be no danger of sharp ones being injured; their points should be protected with cotton and, usually, they are best put by themselves between sterile towels. The latter can be used to cover the bedding during the treatment. (4) Wrap the apparatus in at least two folded sterile towels and secure the bundle with elastic bands; do not use pins.

[1] This gauze should be washed after use and kept.

Demonstration 57

The Collection and Preparation of Specimens of Excreta[1] for Examination

Requisites: 1. The various utensils used for sending specimens of urine, feces, etc., to the laboratory.

2. Labels and any forms that are sent with specimens to the laboratory.

3. Articles required to obtain a specimen of urine from a small child—ones commonly used are: A Chapin urinal and tape to hold it in place; or, absorbent cotton, a fine-meshed gauze compress, oil muslin, and diaper; or, a small bedpan and two pillows protected with rubber cases.

Reasons for Specimens

By chemical and microscopical examination of excreta, discharges, vomitus, and the like, the physician can often obtain much information regarding the nature of the disease from which a patient is suffering and also the progress of the disease and the results of the therapeutic measures employed. With the exception of the urine, excreta and discharges are changed or produced by conditions arising at the site of their origin or parts intimately connected with them; *e. g.*, the feces is changed by abnormal conditions of the alimentary tract or of the glands which produce secretions necessary for digestion; sputum is increased and altered by abnormal conditions of the respiratory tract. As urine, however, consists of (1) material that has been absorbed from the ali-

[1] For means of obtaining specimens of blood, pus, etc., see Chapter XIX.

mentary tract or injected into the blood or tissues and not utilized by the tissues; (2) the products of the chemical changes occurring in the body tissues; (3) substances cast off by the kidney cells; it will show (1) conditions of the alimentary tract that give rise to abnormal substances such as indican; (2) defective metabolism; (3) abnormal conditions of the urinary organs. The nature of the more common abnormal appearances of excreta and their significance will be found in Chapter XIX.

General requirements in the preparation of specimens for examination are:

1. There must be attention to detail. Much delay and annoyance to patients, doctors, and laboratory workers are often occasioned by the nurses failing to observe the details of technique that are taught in connection with the collection and care of specimens. Even apparently unimportant details, such as the side of the specimen container on which the label is put, the order in which the various items of importation are inscribed on the label, the manner of fastening the cover on the container, should be carried out with exactness because, when examining a number of specimens, there is a great deal of repetition in the work and, therefore, it is greatly facilitated when all the conditions under which it is done are the same, and to make these so, as far as the nurses are concerned, requires only a little attention, until the points are fixed in their memories.

2. The specimen utensil and anything else with which a specimen will come in contact is not only to be clean, but should be rinsed with clear water before use, because even minute particles of dust will interfere with a microscopic examination.

3. If the specimen is to be examined for bacteria everything used for it must be sterile, otherwise, it may not be known whether the bacteria found in the specimen were there originally or derived from something with which the latter came in contact.

4. As soon as the specimen is put into the utensil, the latter is to be covered.

5. Enough of the material to be examined must be sent to the laboratory. How much will be enough depends upon the nature of the examination that is required. For any liquid, such as urine, water, milk, about five ounces will be needed because one of the tests for the purity of such liquids is to ascertain the specific gravity[1] and it takes nearly this much to float the instrument used for the purpose.

6. All the information that the laboratory workers require must be written on the label or other form provided for the purpose. This usually includes: The date, the patient's name, the number of the room or ward in which the patient is, the doctor's name, the reason for the examination and, in some cases, the location from which the specimen was obtained and how it was obtained.

7. If a preservative is added to a specimen the fact must be stated on the label; for reasons, see page 305.

Whenever abnormal conditions are noted in excreta, vomitus, etc., the material, usually the whole of it, is to be saved for inspection. The conditions that are to be observed in different excreta, etc., and their significance will be found in Chapter XIX.

Special points to be remembered in connection

[1] What does the specific gravity indicate? If unable to answer see textbook of Physics.

with the collection specimens of different excreta are as follows:

Feces: The chief special precaution required in obtaining specimens of feces is necessary when the examination is to be for ameba. In such case, the feces must be kept warm until the examination is made. Therefore, the bedpan must be well warmed before use and, if the defecation is emptied into any other container, the latter must be warmed; also, it should be taken to the laboratory at once or, if this is impossible, put into a pan of hot (about 110° F.) water.

The examination of feces for biliary calculi, or worms, which is often left to the nurses, should be carried out as follows: Break up or stir the feces with a stick or a spatula and, if necessary, add water and strain the material through gauze stretched across a specimen cup or bedpan or through a fine wire strainer.

Sputum for examination should, when possible, be obtained in the morning before food is taken, as it is then more likely to be free from admixture with other substances. The patient should be given some clear water—not a mouth wash or antiseptic of any kind—and asked to rinse her mouth thoroughly and then to endeavor to cough up discharge from the bronchi or lungs, and she should be given an absolutely clean specimen cup or glass into which to expectorate.

To obtain a specimen of sputum from a small child is sometimes a difficult thing to do. One way that sometimes answers is, when the child coughs, to turn it face downward and to place a clean basin where it will catch any discharge from the mouth. Another method is to wind some absorbent cotton around one end of an applicator or else hold a small

sponge of absorbent cotton with an artery clamp or sponge holder and, after putting something between the child's teeth (such as a small roll of two or three inch bandage or a large cork cut in half) at one side of the mouth, rub the back of the pharynx with the cotton. This usually makes the child cough which forces discharge from the bronchial tubes to where it can be seen and caught with the cotton. The applicator or sponge is then dropped into a sterile test tube and the latter plugged with cotton.

Urine: The measures other than those mentioned under general requirements that are to be observed in securing specimens of urine are: The bedpan or urinal is to be thoroughly washed before use and, for a female patient, the vulva is to be wiped with a damp cloth before the urine is passed or, if a *sterile specimen* is wanted, the patient must be catheterized. Also in such case, the urine must be received into a sterile utensil, which, when possible, should be the specimen glass in which the urine is to be sent to the laboratory, and this must be stoppered with sterile cotton.

When a *twenty-four hour specimen of urine* is required see that the patient voids urine at a noted hour, throw that urine away, but save all that is voided subsequently until the same hour next day. As urine is easily decomposed by bacteria, the bedpan into which the urine is received and the bottle in which it is saved should be sterilized or, if this is not possible, scalded before use—even when a sterile specimen is not required—and the latter should be plugged with sterile cotton, and, if it cannot be kept in a cold place, it will be necessary to add a few drops of an antiseptic to the urine. The antiseptics in general

use for this purpose are chloroform, thymol, and formalin. As already mentioned, when a preservative is used the fact should be stated on the label because the preservatives give some of the same reactions as some of the substances frequently sought for in the urine; for examples, formalin, under some conditions will give reactions stimulating those of sugar and even albumin and it interferes with bile and indican tests; thymol may give a reaction similar to those produced by bile pigments and albumin; chloroform may give a reaction resembling that of sugar, but, if its presence in the urine is known, it, being exceedingly volatile, can be removed before making a test by heating the urine. For this reason, chloroform is more commonly used than other preservatives.

To obtain a specimen of urine from a small child use a Chapin urinal, if possible to obtain one. This answers for both boys and girls. To apply it, put tapes through the openings of the urinal flaps, place the large opening over the vulva, or, with a boy, the penis, with the funnel end downward and secure the urinal in place by tying the tapes around the abdomen and groin. Put the funnel opening into a specimen bottle or, if the child is very restless, omit the bottle and plug the opening with a cork. If such a urinal cannot be obtained, a small glass bottle can be used for a boy baby, place the penis in the bottle and hold the latter in place with tape or a bandage tied first around the neck of the bottle and then around the child's waist. It is somewhat more difficult to obtain a specimen from a girl child, but one method commonly used is to fold a pad of sterile absorbent cotton in a compress of fine, meshed sterile gauze, put this on a piece of oil muslin and place the pad where it will

catch the urine when it is voided; use a diaper to keep the pad in position. After the urine has been voided a sterile rubber glove is put on the right hand and the urine squeezed from the pad into the specimen glass. The objection to this method is that, unless care is taken, pieces of cotton will be in the urine and interfere with microscopic examination. The gauze is used to lessen the danger of this and, therefore, if it is not of very fine mesh it should be doubled. Another method is to notice the frequency with which the child urinates and when it is nearly time for it to do so hold it over a bedpan or else put the pan between two pillows (protected with rubber cases) and lay the child in position for the urine to flow into the pan. The child, unless old enough to understand what is required, will have to be watched.

CHAPTER VIII

Enemata

The nature and purposes of enemata. Precautions necessary in their administration. Equipment and procedure.

An enema (plural enemata) is an injection of liquid into the colon through the rectum. A fundamental difference between enemata and the injections known as *protoclysis* and *enteroclysis*, described in Chapter XII, is that enemata cause more or less intestinal distention and measures are taken to avoid this in the other treatments.

The principal purposes for which enemata are used are: To induce catharsis, *i. e.*, purgative enemata; to cause the expulsion of gas, viz., carminative enemata; to provide the body with nutrient when it cannot be taken by mouth, *i. e.*, nutritive enemata; and to affect local pathological conditions, *e. g.*, emollient enemata which are used to soothe irritated intestinal mucosa, antiseptic enemata, used in the treatment of diarrhea due to microörganisms, anthelmintic enemata, used to kill or cause the expulsion of worms.

In order to appreciate the importance of the technique of these treatments and thus avoid common errors it is necessary to understand certain physiological processes that occur when liquid is introduced into the intestine, viz.:

1. If moderate amounts of a bland liquid are *slowly* injected about *even four* inches into the intestine antiperistaltic waves will be started which will carry the liquid through the colon, sometimes even as far as the cecum.

2. If fluid is introduced quickly, especially in amounts that will distend the bowel, strong peristaltic waves and defecation reflexes are induced which will result in the immediate expulsion of the injection. These are also started by substances that irritate the intestine.

3. Digested substances, water and many drugs that are soluble in water, will be absorbed in varying amounts and with varying readiness from the large intestine; *e. g.*, dextrose[1] solutions that are not more concentrated than 5% are, if administered slowly, usually easily absorbed, but if more concentrated than 5% they are irritating and likely to be expelled; fats,[2] if emulsified, and lecithin,[3] such as is contained in the yolk of egg, and proteins, such as those of milk, meat, and egg, if thoroughly peptonized are absorbed to some extent, but, as a rule, it is thought, not more than a quarter per cent. of the amount given. A small quantity of salt—about ten grains to a pint—added to an enema containing protein is said to promote its absorption.

Conditions that interfere with retention and absorption, in addition to those already mentioned as

[1] Dextrose and similar sugars are, it will be remembered, the final products of the digestion of carbohydrates.

[2] Some authorities claim that fats, if emulsified, are absorbed, and others that not only are they not absorbed but that they interfere with the absorption of other substances.

[3] A nitrogenous phosphorized fat contained especially in milk and egg yolk.

causing prompt expulsion of the injected liquid, are (a) the presence of much feces in the intestine, (b) irritability of the intestine caused by the too frequent administration of enemata, (c) the use of non-soluble substances. The large intestine contains no secretory glands to manufacture digestive juices and the molecules of organic foodstuffs other than soluble sugars must be disintegrated to the relatively simple substances produced by their digestion before they can be absorbed.

4. Hard fecal matter impacted in the intestine can be softened if exposed to the influence of water, dilute soap solutions, or normal saline solutions for from *two to four hours*, the time required depending upon the density of the impaction, and, if glycerine is added to such liquids (about half an ounce to each pint) their penetrating power is increased. Ox-gall solutions and oils were formerly much used to soften feces, but it has been found that they are practically useless for the purpose.

Depending upon their purpose, to be effectual, enemata should be either expelled almost immediately, *e. g.*, purgative enemata; retained for some time and then expelled, *e. g.*, those intended to soften feces and to attain local effects; retained and absorbed, as nutritive enemata and those containing drugs, intended to promote systemic effects. From what has been already said, it can be readily appreciated that to attain the first purpose the enema will be given relatively quickly and contain irritating substances; for the second purpose, it is administered slowly and must be fairly bland; for the third result it will need to be given very slowly and every means taken to avoid irritation.

Important points regarding the anatomy of the rectum to remember when giving enemata are:

1. It, at the anus, slants in an anterior direction (see Fig. 29) but, almost at once, changes its course backward and follows the shape of the coccyx and lower part of the sacrum.

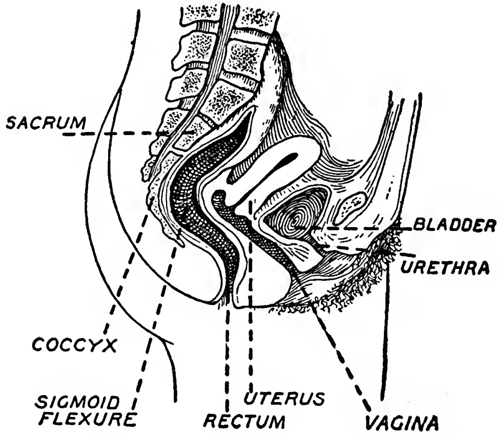

Fig. 29. Showing the curve of the small intestine above the rectum and the relative position and shape of the bladder, uterus, rectum, sigmoid flexure, coccyx, and sacrum

2. The rectum, in the adult, is from six to eight inches in length, above this, which is where the sacrum projects forward (see Fig. 29), the intestine makes a somewhat sharp curve to the left—the sigmoid flexure.

3. The rectum, when not distended by the presence of feces, is in longitudinal folds in which are numerous nerve endings which are stimulated by the entrance of any substance, *e. g.*, a rectal tube, into the organ and the reflexes promoted will cause contractions that may interfere somewhat with the

insertion of the object, but, if the object is not too irritating, it, in a short time, will cease to induce such strong stimulus.

It is because the above facts are not borne in mind that difficulty is often encountered in inserting the rectal tube and starting the flow.

Position of patient: Formerly it was thought that, because of the curve of the sigmoid flexure, better results would be obtained if the patient were placed on her left side, but X-ray pictures have shown that the strong antiperistaltic waves excited by the entrance of the fluid carry the latter up just as readily when the patient is lying on her right side or her back and the latter position has often advantages, *e. g.*, it is the position in which a very ill patient is likely to be lying. An important point to remember about the position, whether the patient is on her back or side, is that the thighs should always be flexed when possible so as to relax the abdominal muscles and lessen pressure on the intestines.

When there is a high intestinal obstruction, the enema is sometimes given with the patient in the knee chest position (see page 277) or with the foot of the bed elevated about two to three feet, as it is thought gravity may possibly help in getting the fluid higher into the intestine.

Demonstration 58

Purgative Enemata

Purgative enemata act (1) by irritating the intestinal mucous membrane and so promoting peristalsis, (2) by distending the bowel and thus stimulating the expulsive reflexes, (3) by softening feces. Irritation

being one of the factors, some substance that is irritant to mucous membranes, usually soap, is one of the constituents of these injections.

When giving a purgative enema, a nurse should have two aims in view: (1) to get a good result, (2) to cause the patient as little discomfort as possible.

To appreciate the **importance of getting a good result** it must be remembered that if waste matter is allowed to accumulate in the intestine it is, under the influence of bacteria, changed to substances that are highly toxic to the body and that are readily absorbed. It is one of the functions of the liver to modify these substances, so that they will be less injurious to the body, and of the kidneys to excrete them. Even in health, however, autointoxication and consequent malaise will occur, in spite of the liver's efforts, if constipation is at all intense. In illness, constipation and the retention of waste are much more common than in health, for several reasons, especially the lack of intestinal tone which interferes with effectual peristalsis, and the restriction of diet and of exercise. Naturally, the presence of such toxic matter is even worse in disease than in health, for (1) the liver and kidneys may not be functioning properly, and, even if they are, their work should not be intensified; (2) the diseased condition is probably giving rise to other toxic substances and thus it is most important to avoid any unnecessary addition.

To get the best results and avoid annoying the patient unnecessarily the following precautions should be observed[1]:

[1] The pupils should be required to tell the reasons for all the precautions that have bearing on the physiologic and anatomic conditions mentioned in the first part of the chapter.

1. Avoid unnecessary exposure of the patient.

2. Protect the bed adequately from both soil and odor.

3. Lubricate the tube, but remember, a small amount of lubricant, covering as much of the tube as is to be inserted, is all that is required and, if more is used, the bedding may be soiled and it will be difficult to clean the tube.

4. Avoid putting air into the intestine, for it will cause useless and unnecessary irritation. This will be done by (a) failure to remove the soapsud bubbles from soap solution enemata; (b) forgetting to let solution run through the tube before inserting it; (c) allowing the solution to get below the exit aperture of the reservoir while the tube is still in the rectum.

5. Do not use force when inserting the rectal tube and, to avoid the necessity of doing so, insert it slowly, holding it in such position that it will follow the course of the rectum (see Fig. 29), and do not insert it farther than, according to the size of the patient, four to six inches, for the antiperistaltic waves excited by the flow of the liquid into the intestine will carry the fluid onward and, if the tube is pushed, it is likely to be jammed against the sacrum or coiled in the rectum and the flow thus interfered with, therefore, if it is necessary to aid the flow do so by gravity and either raise the patient's pelvis on pillows or else raise the foot of the bed.

6. Regulate the flow according to the effect desired. As already stated, if the fluid is introduced quickly, it will be expelled at once and a washing out of the lower part of the bowel will probably be the only result, and, ordinarily, to get the best effects, an enema should be retained for at least ten or fifteen minutes.

An exception is when, especially following catharsis or an enema to soften feces, the enema is given chiefly to produce a strong expulsive effort. The rate at which an enema can be given depends very greatly upon the patient. A good rule to follow is to regulate the flow by the height of the reservoir and to hold this at first not more than two feet above the patient and, if she can stand a stronger current, raise it gradually to a height of three feet and to lower it for a time when distress is caused.

7. If the patient is afraid that the tube will slip out hold it near the anus.

8. Occasionally the rectum is so packed with feces that the entrance of the tube and the flow of the current is interfered with. In such case, put on an old rubber glove and using your index or middle finger remove the impaction. Should the flow at any time be checked because of feces in the tube remove the latter from the rectum and let the liquid flow through it forcibly.

9. Pinch the tube while removing it (otherwise the fluid will drip on the bed) and remove it quickly.

10. Exert pressure on the anus after removing the tube until desire to expel the liquid is lessened.

Equipment: 1. A bath blanket, two if the ward or room is cold.

2. An enema rubber.

3. Two dressing towels or a towel and a draw sheet.

4. An irrigator containing the solution, and connected with about three feet of rubber tubing supplied with a stop-cock.

5. A rectal tube attached to the irrigator tubing with a glass connecting tube.

6. Vaseline or other lubricant. Soap solution is sometimes used for purgative enemata, but not for other varieties.

7. A bedpan.

8. Toilet paper.

9. A dressing basin containing hot water and a washcloth or compress. This will not be needed until after the patient has used the bedpan.

10. A Chase doll for subject.

Procedure: Gather the equipment and then prepare the solution. As previously stated, soap is commonly used. Except when very strong irritation is desired, pure oil soaps, as Castile and ivory, should be used, and not laundry soaps which nearly always contain free alkalies. The latter should never be used for children, unless ordered by the physician. Enough soap will be needed to make a white-looking solution.[1] This, if standard soap solution[2] is used, requires about one ounce for each pint of water. Ordinarily, two to three pints[3] are required for an adult. The solution is usually made about 108° F. This allows for 4° or 5° cooling while arranging the patient. Remove the froth; it contains air.

Take the equipment to the bedside.

[1] It is a common custom in hospitals to collect all small pieces of unscented toilet soaps and keep them in either a bottle containing water enough to dissolve them or a soap-shaker, and the latter is stirred in the water when the enema is prepared.

[2] A 20% solution of Castile soap.

[3] More than four pints should never be used, unless prescribed by a physician, and when a patient is getting enemata constantly as small an amount as possible to get results should be used, for frequent overdistention of the intestines tends to promote obstinate constipation by accustoming the intestine to excessive distention.

Replace the upper bed covers with the bath blanket,[1] folding the former to the foot of the bed.

Put the rubber under the patient; it should extend from the small of the back to the knee joints, and cover the portion with which the patient comes in contact with a dressing towel or a folded draw sheet. If the latter is used, after the patient is in position, draw it up, loosely, over her legs, under the blanket.

Place the patient in position (see page 311). Turn her nightgown out of the way.

Warm the tube and expel air from it by letting solution run through. Shut off the flow.

Lubricate the rectal tube.

Insert it (see Precaution 5). This, after practice, can be done without looking, and it is not necessary, even for the inexperienced pupil to actually expose her patient. To avoid doing this, draw back the portion of the side of the blanket that is on a line with the lower part of the pubes; all necessary inspection can be made between the folds thus made in the blanket.

Open the stop-cock.

Raise the reservoir about two feet above the patient (see page 313). It is a common rule in hospitals that, except when the patient is very restless and may need restraint, the reservoir is not to be hung up, but is to be held by the nurse, so that it will be impossible for her to leave the patient while the solution is flowing in. If distress is caused lower the reservoir somewhat for a short time.

When the required amount has been given, withdraw the tube following the instructions mentioned

[1] If the bed covers are allowed to remain over the patient, they become permeated with the fecal odor.

in Precaution 9. Press the towel against the anus until desire to expel the fluid is lessened.

Place the patient on the bedpan. Encourage her to retain the enema for ten or fifteen minutes.

After the liquid, etc., has been expelled, care for the patient as described on page 129. If she is in a room, and it is permitted, open the window, taking means, if necessary, to protect her from the cold. Remove, clean, and put away the apparatus as described in Chapter I. Record the result of the enema on the chart at once.

Demonstration 59

Method of Giving Purgative Enemata to Young Children

With young children it is an irrigation, rather than an enema, that is given, for they generally either cannot or will not retain the injected fluid. Therefore, it is usually necessary to do either of three things: (1) keep the child on the bedpan during the treatment; (2) hold it in the lap; (3) place it on the edge of a table with a Kelly pad under the buttocks.

Equipment: The same as for Demonstration 58 except: The draw sheet will not be needed, but an irrigator stand and, if the child is held in the lap, a rubber apron and a safety pin will be; a rubber catheter is substituted for the rectal tube; only one pint or a pint and a half of solution will be needed, and, if soap solution is used it should be only about half as strong as that used for adults, many physicians prefer normal salt solution to soap for the purpose as a child's mucous membrane is very easily irritated.

Procedure: The main differences in giving an enema to a child, if it is placed on the bedpan are: The reservoir must be placed on the stand, about *twelve to eighteen inches* above the child, instead of being held, for it may be necessary to control the child's movements; the catheter is inserted only about three to five inches, according to the size of the child, and it must be held in place.

If you hold the child in your lap, protect yourself with the rubber apron; turn the child's clothing above, and pin one end of the rubber around, its waist; put the free end of the rubber in a bedpan or pail and arrange the sides to form a trough; protect and, if necessary, restrain the child with a small blanket or folded sheet; while giving the injection keep the child on its back and hold its legs flexed upon its abdomen. Proceed in the same manner if you place the child on the edge of a table, but a Kelly pad can be substituted for the rubber trough.

Demonstration 60

Enemata for which only a Small Amount of Fluid is Used

Differences in equipment and procedure for such enemata and those already described are:

1. When the enema is not given to promote defecation it is not necessary to turn the bed covers to the foot of the bed, but it facilitates matters if the blanket, doubled, is put over the trunk and the covers are turned back so that they just overlap the lower edge of the blanket two or three inches at the groin.

2. Especially when the enema is to be retained,

use a rubber catheter,[1] instead of a rectal tube, for, being smaller, it will cause less irritation. Connect the catheter by means of a glass connecting tube with rubber tubing twelve to eighteen inches in length and of one quarter of an inch bore, and unless a small irrigator can be obtained, insert a funnel in the free end of the latter. If the funnel is used, keep the liquid in a pitcher and, after lubricating the catheter, fill the funnel, allow some of its contents to run through the catheter, back into the pitcher, compress the tubing against the lower end of the stem of the funnel,[2] so as to keep some of the solution in the funnel which is never to be emptied until the treatment is through.

3. After inserting the catheter about four to five inches, wait a full minute before allowing the flow to start, maintaining pressure against the anus during this time. Do so again, before removing the catheter after all the fluid has been given, exerting pressure on the tubing in the meantime to prevent the entrance of air into the intestine.

When the enema is to be retained it is most important:

1. To remove the catheter quickly and to make firm pressure against the anus until desire to expel the liquid has ceased.

2. To keep the patient quiet. It is often advisable to raise the patient's hips on pillows before giving

[1] Catheters used for this purpose must be kept separate and never substituted for those used to catheterize the bladder.

[2] It is well to hold the funnel as shown in Fig. 23, with the little finger in front of the tubing, just at the bottom of the funnel stem, for by moving the finger backward and upward the tubing is pressed against the stem and the flow thus easily checked.

the enema, or, if the patient is in poor condition, to raise the foot of the bed from three to six inches, this disturbs the patient less and is more comfortable and provides almost as efficacious a position.

3. The rectum and even the colon must be free from feces. This is especially important for nutritive enemata; therefore, patients getting these are given a purgative enema daily and this should be given at least two hours before a nutritive one, so that all irritation of the intestine will have ceased.

Injections for Amelioration of Diseased Conditions of Rectum

When injections are given for action upon the rectum a short nozzled syringe should be used instead of a catheter so that the liquid may be injected where it will come in contact with the parts it is to affect. Otherwise the procedure can be carried out as just described.

Ingredients Used for Special Enemata

Anthelmintic Enemata

Anthelmintic enemata in common use are: Infusion of quassia; limewater; solution of tannic acid, 1:2000; solution of alum, thirty grains to the pint. These enemata are given in the same manner as the purgative.

Carminative Enemata

For the so-called carminative enemata substances are used that will produce a stronger stimulation

than the ordinary soapsuds enema and thus promote forceful contractions of the intestinal muscle and the consequent expulsion of flatus. Common prescriptions are:

1. Tincture of asafetida, four drams to one pint of hot strong soap solution.

2. Spirits of peppermint, one dram to one pint of hot soap solution.

3. Turpentine, one dram; magnesium sulphate, one ounce with one pint of soap solution.

4. Turpentine half an ounce in one pint of soap solution made with yellow laundry soap, followed by an enema of two pints of soap solution.

Enemata to Soften Feces

A common prescription is half an ounce of glycerine in one pint of dilute soap solution, to be retained and followed in four hours by a soapsuds enema. As the first enema, to be effectual, must be retained from two to four hours, it is to be given very slowly.

Emollient Enema

Starch is the emollient most used for this form of administration.

To make a starch enema, mix one teaspoonful of starch with a tablespoonful of cold water. Add slowly, while stirring, two tablespoonfuls of boiling water and boil until a smooth, translucent paste is made, then add, very slowly, enough boiling water to make half a pint. Cool to 106° F. before administering.

Nutritive Enemata

Common prescriptions are:

1. Dextrose half an ounce to eight or ten ounces of water.

2. As above substituting half to two ounces of liquid peptonoids for an equal amount of water.

3. Half an ounce of dextrose, one egg, and six ounces of milk that have been peptonized, ten grains of salt.

To prepare this enema: Dissolve two and a half grains of pancreatin and seven and a half grains of bicarbonate of soda in a little tepid water, add this to the milk, beat the egg with a fork and add it to the milk, stir the mixture, and let it stand in a pan containing water that is kept between 115° and 110° F., for at least two hours. Just before administering the enema add the salt and dextrose.

Three or four enemata are, as a rule, administered during the twenty-four hours and enough egg and milk for the day's use can be prepared at one time, all not required for the first enema being put in the ice-box and kept there until needed and then heated to the required temperature and combined with the dextrose and salt.

4. The same as No. 3, minus the egg.

CHAPTER IX

Lavage, et cetera

Lavage of the stomach. Expression of the stomach's contents. Duodenal expression and flushing. Gastric and nasal gavage. Gastrostogavage.

Demonstration 61

Gastric Lavage

The term lavage signifies the washing out, douching, or irrigation of an organ. It is used more especially for the washing of the stomach.

The purposes of the treatment are the same as those for the douching of other mucous-lined cavities (see page 339), and the removal of poisons[1] or irritating material.

Requisites: 1. A stomach tube,[2] eighteen inches of which are to be in a basin containing ice,[3] the tube being coiled around the ice.

2. Rubber tubing about eighteen inches in length with a funnel in one end and a glass connecting tube

[1] Lavage is performed after opium poisoning even when the drug has been taken by hypodermic, because opium is excreted into the stomach and intestines.

[2] A soft rubber catheter (about No. 16 American or No. 24 French) is used instead of a stomach tube for a small child.

[3] The cold hardens the rubber and facilitates the passage of the tube.

in the other; the latter is also inserted in the open end of the stomach tube.[1]

3. A pitcher containing water or the solution prescribed; this is very frequently either boric acid, two per cent., or sodium bicarbonate, five per cent. The temperature usually prescribed is 105° F.; from one to two quarts are generally used.

4. A rubber apron.

5. A towel.

6. A gauze compress which is to serve as a handkerchief for the patient.

7. A little glycerin to lubricate the tube.

8. A kidney basin, this will be needed if, as sometimes happens, the patient vomits.

9. If the patient is likely to resist the passage of the tube something to put between the teeth will be necessary; this may be a mouth-gag, a small roll of bandage, or a cork.

These articles should be carried to the bedside on a tray, and covered with a towel.

10. A pail and a small rubber to put under it to protect the floor.

Points to be remembered: 1. Before starting the treatment, it is most important to reassure the patient and to instruct her to make the motions of swallowing as the tube goes down the esophagus and to breathe naturally; for, if she does so, the passage of the tube is an easy matter while it is very much the reverse if she struggles.

2. Unless specially ordered or in emergency, lavage should not be performed within three hours after a meal.

[1] Some stomach tubes are long and have a rubber funnel attached; if such is used these articles will not be required.

3. Do not hold the funnel more than three or four inches above the patient's mouth for the liquid is not to be introduced into the stomach with force.

4. Do not push the tube forcibly when introducing it, great harm might be caused were it driven forcibly against the walls of a diseased stomach.

5. Do not allow the funnel to become empty except while it is inverted for siphonage, for, if it does, siphonage will be interfered with.

6. If there is any obstruction to the passage of the tube, or if gastric pain is caused by the introduction of the fluid, or if there is any sign of blood in the siphoned liquid, discontinue the treatment until you have reported the fact to the doctor, for in certain diseases, as carcinoma or ulcer of the stomach, a dangerous hemorrhage might be caused.

Procedure: Wash your hands. The treatment can be given with the patient either sitting up or in bed. If she is in bed move her to the edge, and make her comfortable in a semi-sitting position with pillows.

Put one end of the towel over the upper border of the rubber apron and tie the latter around the patient's neck; at the same time, if she has on a collar, remove it and see that her clothing is loose around the neck.

If she has false teeth on a plate remove them.

Place the pail, with the rubber under it, on a chair or the floor in position to receive the siphonage.

Put the funnel open end down on the table and expel the air as well as possible by, if there is not a pump on the tube, stretching and squeezing the tubing (it is not usually expelled by filling the tubing with water, as when giving an enema, because if the patient resists, some of the water in the tube may get into the trachea).

Lubricate the tube with glycerin. Do not use much and never use oil as this would be likely to nauseate the patient. When the patient is accustomed to the passage of the tube no lubricant is necessary, the mucus in the throat being sufficient, but if the patient is unaccustomed to the treatment the throat may be very dry, as the result of nervousness, and this would interfere with the passage of the tube.

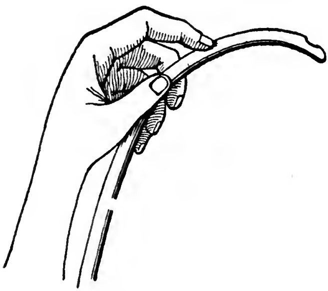

Fig. 30. Method of holding lavage tube curved so that it will not strike wall of pharynx.

Give the patient the gauze handkerchief and place the kidney-basin where she can reach it easily.

Stand on the right side of the patient somewhat behind her so that you can support her head with your left arm, take the tube about three inches from the tip and holding it somewhat curved, so that it may follow the curve of the palate and thus avoid striking the back of the throat (which would gag the patient), insert it gently, keeping it just above the tongue; tell the patient to swallow as soon as it reaches the back of the throat, insert it until the circular mark, which is eighteen inches from the tip, is at the teeth.[1] Have the patient bend her head slightly forward that the extra secretions incited by the irritation of the tube may run out of her mouth.

Then fill the funnel with water, raise it about six inches above the patient, and allow the water to flow

[1] Not quite so far as this for a child or very small adult.

in slowly; when the funnel is half empty refill it. Keep track of the quantity used. When about a pint has been given, while the funnel is still half full, quickly lower and invert the latter so that the fluid will siphon back. If it fails to do so pour a little more into the stomach and as you lower the funnel tell the patient to press upon the abdomen and contract the abdominal muscles.

Almost as much liquid should return as was given; when it begins to flow slowly, turn the funnel and fill it quickly so that the tube will not become filled with air. Repeat the process until the required amount of solution has been given. A common prescription is that the treatment should be continued until the solution returns clear of mucus.

Pinch the tube when removing it and remove it quickly. Put the tube and funnel in the basin and release your pressure on the tube.[1]

Make the patient comfortable and remove the apparatus.

Record the result of the lavage and state whether mucus or other foreign substance was present in the siphoned liquid and how much liquid was used before it returned clear.

Demonstration 62[2]

Expression of the Stomach's Contents

The contents of the stomach are sometimes removed by inserting a tube into the stomach and re-

[1] If you do so sooner the water in it may flow on the floor or the patient.

[2] This procedure is usually performed by the doctor and only the arrangement of the apparatus can be demonstrated, but the nurses must understand the nature of the procedure in order to give efficient assistance.

moving the air from this by means of a pump or syringe. This will have the desired effect because, when the air in the tube is exhausted, the pressure within the tube is nil, *i. e.*, there is a vacuum, and the pressure within the stomach forces the material that the organ contains into the tube. This operation is commonly termed *expression*.

The usual purpose of this procedure is to discover the motor and secretory capacity of the stomach, and to determine this, a stated number of hours before the expression is to be performed, the patient is sometimes given certain accurately measured or weighed foods of which the time required for digestion is known. The motor capacity of the stomach can be estimated by the amount of material remaining in the stomach and the effectiveness of the secretory glands by the degree of digestion that has taken place and the amount of acid present. (The two conditions last mentioned are determined in the laboratory by special chemical tests.) Normally, even after a full meal, the stomach will be empty eight hours after the meal, and when empty it will not secrete hydrochloric acid.

Equipment: 1. A stomach pump[1] or a stomach tube and a syringe or suction pump with or without a suction bottle. The eighteen inches of tube to be inserted should be coiled around ice in a basin.

2. Glycerin to lubricate the tube.

3. A towel and safety pin.

4. A receptacle to receive the expressed material. If a suction bottle is used it will answer this purpose.

5. A gauze compress or a handkerchief.

[1] A common form of stomach pump is similar to a lavage tube, but is supplied with a bulb that, when squeezed, acts as a suction pump.

6. A kidney-basin or small bowl.

7. If a suction bottle is used, a glass connecting tube.

These articles should be taken to the bedside on a tray and covered with a towel.

Procedure: Have the patient sitting comfortably.

Pin the towel around her neck and if she has on a tight collar loosen it.

Place the receptacle for the material that is to be drawn from the stomach in position; it should be somewhat lower than the patient's stomach.

Place the bowl where the patient can reach it if an excessive flow of saliva and mucus is incited by the passage of the tube.

Lubricate the tube if necessary, and pass it as for lavage.

Withdraw the air from the tube.[1]

[1] The method of doing this will depend upon the appliance used. To use a stomach pump, squeeze the bulb. An ordinary piston syringe may be used as follows: Remove air from the syringe by pushing the piston toward the point; insert the point in the free end of the stomach-tube and draw the piston outward. If the syringe is not large enough to extract all the air at once, compress the tubing above the point, withdraw this from the tubing, push the piston down, reinsert the point, and repeat the process. Do this until fluid begins to flow. If a doctor is giving the treatment have two syringes if a large one cannot be had and hand him one ready for use as soon as he withdraws the other.

The suction bottle (see Fig. 31) is used as follows: Expel air from the bottle by closing clamp 1—*i. e.*, that on the tubing which is to be connected with the lavage tube—and open clamp 2—that on the tubing connected with the pump—and drawing the piston back and forth (unlike the syringe there is an exit for the air that is withdrawn on the pump). When the air is exhausted, close valve 2, connect the tubing extending from valve 1 with the lavage tube by means of the glass connecting tube; open valve 1. The stomach contents should flow into the bottle.

Expression of Duodenal Contents[1]

Duodenal Lavage

Material is sometimes withdrawn from the duodenum for diagnostic purposes in much the same way as from the stomach. This is done by the physician and the nurse's duties are much the same as for the expression of gastric material.

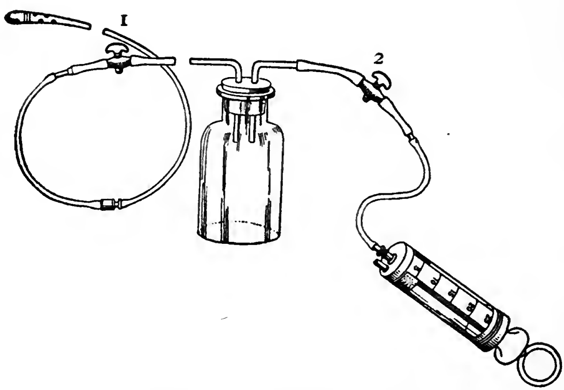

Fig. 31. Duodenal tube with suction bottle and pump.

The equipment required is also usually the same plus litmus paper or other indicator and two or three pillows and the substitution of a duodenal tube for a lavage tube. The duodenal tube in common use

[1] This and the treatments following cannot usually be demonstrated in class but, as the general requirements are about the same as those for the two treatments just described, if their technique is understood and the pupils read the following descriptions and are questioned in class, they should be able to assist with the treatments and in this way learn how to give those which they may be required to.

differs from the latter in being somewhat stiffer and having a metal capsule on the tip.

The procedure is about as follows: The patient is not given food for the twelve hours preceding the time set for the operation so that the stomach will be empty, but is encouraged to drink warm water in small amounts at frequent intervals.

For the operation, the patient sits up at first, as when the lavage tube is passed, but after the tube reaches the stomach, she is made to lie down on her right side and pillows enough (usually two are required) are put under her hips to raise them eight or ten inches. This is to make the pyloric end of the stomach dependent, which, aided by gastric peristalsis, causes the capsule to pass slowly into the duodenum. The patient can drink a little water from time to time if she wishes to.

When the second mark on the tube is reached (this is about seventy cm.—twenty-eight inches—from the point), the suction bottle, after the air has been expelled, is connected with the duodenal tube, the bottle placed somewhat lower than the patient, and the valve on that side opened, whereupon the duodenal contents will be forced into the bottle. In order to ascertain if it is intestinal, and not gastric, matter the reaction is tested with litmus or other indicator. Once the flow is well started, it will not be interfered with if the cork in the suction bottle is loosened to allow of using the indicator so long as the flow is not checked in the process. Duodenal material will be of alkaline reaction and under such circumstances it will be viscid and of uniform color. Gastric material is acid or, if there is no food present, neutral.

If the intestine is to be lavaged, after the outward flow ceases, the suction bottle is disconnected, the patient sits up, and the duodenal tube is connected with (after air has been expelled from it) the tubing of an irrigator containing the solution that is to be injected. The irrigator is suspended about six inches above the patient and about a quart of solution is allowed to flow through the tube very slowly. It is not siphoned back, as in gastric lavage, the object being to let it pass through the entire intestinal tract, from which it will be ejected, usually, in the course of an hour or two. That it may do this and not be absorbed, a drug that will prevent absorption is put into the solution, sodium sulphate about nine to fifteen grams to the quart being frequently used for the purpose.

The tube is withdrawn more slowly, but otherwise in the same way as the lavage tube.

Gavage

By gavage is meant the introduction of food into the stomach through a tube. Unless otherwise specified, it is the stomach tube that is used. Food and medicine may be given in this way when the patient either cannot or will not take them in the usual manner. Any form of liquid food can be given by gavage.

Requisites: 1. The food.

2. The stomach tube, lengthened, if necessary, with tubing.

3. A funnel which is inserted in the open end of the tube.

4. Glycerin to lubricate the tube.

5. A towel.

If the patient is delirious or insane, some restraining appliance may be necessary and a mouth gag or substitute.

Procedure: Wash your hands.

Restrain the patient, if absolutely necessary, and, in such case, put the mouth gag between her teeth.

Place the patient in the same position as for lavage.

Put the towel around her neck.

Lubricate a few inches of the tube.

Expel the air from it and introduce it in the same manner as for lavage.

Fill the funnel, but allow a few seconds to elapse before letting the liquid run so that the muscular contraction induced by the insertion of the tube may subside, otherwise, particularly if the patient is nervous or struggling, the food may be vomited. Do not hold the lower part of the funnel more than three or four inches above the patient for the liquid should enter the stomach slowly.

As soon as the last of the food has left the funnel, compress the tube at the stem of the funnel and, with the other hand, grasp the tube near the patient's mouth and whip it out quickly.

Nasal Gavage

Especially when a patient is obstreperous, it is likely to be easier to feed her by introducing food into the esophagus through the nose than in the manner just described. This method is termed *nasal feeding* or *nasal gavage*. It is used also following many operations on the mouth.

Requisites: The same as when the stomach tube

is used except for the substitution of a catheter for the tube and, even if the patient is obstreperous, a mouth gag will not be necessary.

Precautions: 1. Use no force when inserting the catheter, if there is any obstruction in the nostril, remove the tube and insert it in the other side, for the septum of the nose is rarely straight and, consequently, if one of the cavities is smaller than normal, the other will be just so much the larger.

2. Especially when giving the gavage following an operation on the mouth, look into the latter before letting the liquid enter the tube, because the catheter occasionally enters the mouth, instead of the esophagus.

3. Wait a few seconds after introducing the catheter before pouring in the liquid, for retching may be induced by the irritation of the tube, and if the food is given before this subsides it may be vomited. Formerly it was taught that it was necessary to do this because there was danger of getting the catheter into the larynx and, if food were then poured in, the patient would be practically drowned, but experience has shown that it is almost impossible to do this unless the patient is in such a state of shock that the throat muscles are almost completely relaxed and, if the catheter did enter the larynx, such a spasm of coughing would be induced that it would be clear that something was wrong. Of course if the patient were in collapse or under the influence of an anesthetic the cough reflexes might not be stimulated, but the patient would become cyanosed and if the funnel were held to the ear a whistling sound would be heard.

Procedure: Wash your hands. Put the towel around the patient's neck.

The patient can be either lying down or sitting, but her head is to be either straight or bent slightly forward for, if it is bent backward, the catheter is likely to enter the mouth.

Lubricate three or four inches of the catheter and insert it, keeping it slightly curved and pointing toward the septum. It is to be passed into the esophagus for about four inches, but it is not necessary for it to reach the stomach.

The fluid is to be given slowly, therefore, hold the funnel with its lower opening not more than three inches above the patient. As soon as the last of the liquid has left the funnel compress the catheter and remove it quickly.

Gastrostogavage

By gastrostogavage is meant feeding through a gastric fistula. A gastric fistula or opening into the stomach is made for this purpose when an obstruction in the esophagus or cardiac end of the stomach prevents the person taking food in the usual manner. Common causes for such obstructions are: Carcinoma and contractions resulting from erosion by corrosive poisons.

When the fistula is made a catheter is inserted and the free end of the latter is brought above the surgical dressing, and the binder covering the wound and it is clamped near the opening.

Requisites: 1. The food.[1]

2. A funnel with about three inches of tubing

[1] Any kind of liquid food can be given in this way. Milk, plus dextrose and finely divided protein material, as prepared caseinogen, is commonly used.

attached and a glass connecting tube in the free end of the latter.

Carry these to the bedside in a basin or on a tray covered with a towel.

Procedure: Put the towel around the free end of the catheter. Fill the funnel. Expel the air from the tubing by letting some of the liquid flow through and back into the pitcher.

Insert the connecting tube in the catheter and open the clamp.

Let the fluid flow slowly into the stomach. Do not allow the funnel to become empty during the process, and as the last of the food flows from it clamp the catheter. Compress the tube and remove it.

Precaution: Care must be taken when handling the catheter for, otherwise, it may slip either into or out of the stomach.

CHAPTER X

Douches

The requisites for and methods of giving spinal, vaginal, intra-uterine, nasal, throat, ear, and eye douches.

By a douche is meant a stream of water directed against a part. Both the outer surfaces of the body and the cavities connecting with it are so treated.

External Douches

The effects of douches applied to the exterior of the body, like those of baths, are obtained by the stimulation of nerve endings affected by cold or heat plus those stimulated by the percussion of the water thrown upon the body. The results of such stimulation were discussed in Chapter VI.

The most common purposes for the use of such douches in therapeutics are the invigoration of the nervous system and improvement in the general tone and nutrition of the body.

The back is the most common site of treatment and this constitutes the so-called *spinal douche.* To get the best effects from such douches requires appliances such as are used in hydrotherapy departments, but, as the means of using these depends upon the variety, and is so much more easily explained and understood with the apparatus at hand, only sugges-

tions for giving such a douche in the home or a hospital where there is no regulation apparatus will be considered here. Whatever the apparatus used, the same precautions are necessary as for baths.

Demonstration 63

Spinal Douche

Equipment: 1. A foot tub three fourths full of water about 112° F.; stand this in the large bath tub, near the head.

2. A piece of board about twelve inches wide, slightly longer than the width of the tub, and strong enough to hold the patient; place this across the tub, near the head.

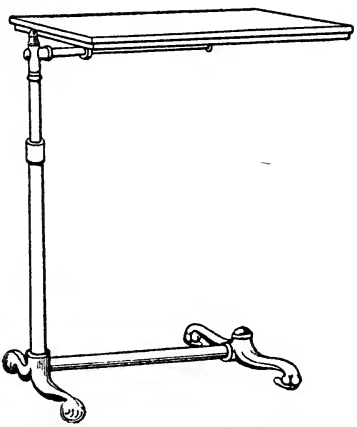

Fig. 32. Type of table that can be used for Demonstration 63.

3. A small pillow protected with a rubber case under the white; put this on the board.

4. An adjustable bedside table.

5. A bath spray; attach this to the faucet.

6. A bath blanket.

7. A bath towel.

8. A safety pin.

Procedure: Put the blanket around the patient with the opening at the back.

Undress the patient and have her sit on the board with the pillow under her and her feet in the foot tub.

Arrange the blanket so that the patient's chest and thighs are covered and her back well exposed. Pin it at the neck to keep it in place.

Place the table with the shelf across the tub so that the patient can lean forward and rest her arms on it if she wishes to.

The usual prescription for the temperature is to use the water as it comes from the cold water tap; or, sometimes, to alternate hot and cold, and, in such case, test the hot water on your own arm each time, for if the temperature is changed after the spray is attached, it is not practical to regulate it definitely with the thermometer, unless there is a regulation tank.

Spray the water up and down the back for the length of time required (usually twenty minutes) with all the force obtainable.

Dry and dress the patient and put the apparatus away.

Douches for Body Cavities

The common aims in douching body cavities are: (1) To cleanse them; (2) to relieve congestion or inflammation; (3) to check hemorrhage; (4) to disinfect the cavities.

The accomplishment of these aims is dependent upon: (1) The mechanical cleansing effect of the running water; (2) the effects of heat or, occasionally, cold; (3) the action of the drug in the solution, this may be either astringent, antiseptic, soothing or detergent and many of those used have two or more of the qualities.

To understand the conditions in body cavities

which, ordinarily, occasion the need for cleansing douches (other than used to prepare the parts for operation) it is to be remembered that the cavities continuous with the exterior of the body are lined with mucous membrane and this, under the influence of irritation, is easily congested and its secretory cells rendered active. As the result of these conditions, there is likely to be an increased exudation from the blood-vessels and an excessive secretion of mucus. If the irritation is due to pyogenic bacteria, there is also likely to be pus present; *i. e.*, the discharge will be muco-purulent. The amount of discharge is one of the most important indications of the severity of many pathological conditions of body cavities and thus it is very essential to note and record this as definitely possible.

Demonstration 64

Vaginal Douches

Five facts regarding the structure of the vagina and uterus that should be borne in mind when giving vaginal douches (much of the technique being based upon these) are: (1) The vagina curves backward except at its upper extremity where it follows the contour of the cervix, see Fig. 29, (2) its posterior wall is about two and a half to four inches in length and its anterior two to three inches; (3) the neck of the uterus projects into the vagina, see Fig. 29; (4) the interior of the vagina, like that of most organs that are capable of great distention at times, contains many folds or ridges in which discharges can collect; (5) normally, the walls of the cervix, particularly at

the external os, are in close apposition, but, especially after a woman has borne children, in pathological conditions they may become so much relaxed that, if liquid is injected with force, discharges can be washed into the uterus.

Solutions commonly used for vaginal douches are:

Acetic acid 1 : 50 of 6% (for checking hemorrhage).

Bichlorid of mercury 1 : 3000 to 1 : 10,000.

Boric acid 1 : 25 to 1 : 50.

Carbolic acid 1 : 120 to 1 : 200.

Creolin 1 : 400.

Chlorinated soda 1 : 300.

Green soap 1 : 75 (sometimes used when preparing for local operations).

Iodine 1 : 200 of 7% tincture.

Lysol 1 : 400.

Normal saline solution.

Sterile water.

Silver nitrate 1 : 100.

The usual temperature for a cleansing douche is 110° to 115° F.; for one used to relieve inflammation 115° to 118° F.; to check hemorrhage 120° F.

The quantity generally used is from two to three quarts.

Equipment. 1. An irrigator stand.

2. A bath blanket.

3. Two sterile dressing towels.

4. A douche can with a rubber tubing attached and a stop-cock on the tubing.

5. A douche nozzle. A glass catheter is sometimes substituted when giving a douche after perineorrhaphy has been performed.

6. A dressing basin containing solution (the same as that used for the douche or else a hot 1% green

soap solution) and gauze sponges, the number depending upon the amount of discharge.

7. A receptacle for used sponges.

8. A thermometer.

9. If the patient has a purulent discharge, or following operations on the genitalia, sterile rubber gloves. These are used in the first case to protect your own hands from contamination and in the second, to protect the patient.

10. A Chase doll for subject.

Preparation of apparatus: Sterilize the douche nozzle and after delivery or operations on the genitalia or surrounding parts,[1] the reservoir and tubing. At other times it is generally considered sufficient preparation to fill the can with boiling or very hot water and let it run through the tubing.

Scrub your hands.

Prepare the solution.

Examine the douche nozzle *carefully* to see that it is intact, for glass appliances are often cracked during sterilization. Never touch the part of the nozzle that is to be inserted. Connect the nozzle with the tubing.

Expel the air from the tubing and nozzle by letting the solution run through them.[2]

[1] Whenever there is a wound from any cause exactly the same aseptic care must be exercised as when caring for wounds in any other locality; in fact wounds in these parts are particularly readily infected and infection is likely to be followed by very serious consequences.

[2] Air must always be expelled from tubes before they are inserted in body cavities for the conveyance of liquid. This is generally done just before the tube is inserted, because liquid remaining in the tubing after the flow is checked becomes cold quickly, but as ordinarily it takes a very short time to prepare

Place the nozzle between the folds of the sterile towel.

Put the irrigator in the douche pan and cover the top with a towel.

Place the towel containing the nozzle on the shelf of the pan and arrange the tubing so that it will not be dragged upon.

Procedure: Replace the bed covers with a bath blanket. Have the latter with its length across the bed.

Remove the pillows from under the head and place one under the back below the shoulders. The trunk is to be in such position that the pelvis, which is raised on the douche pan, is higher than the shoulders which are to rest flatly upon the bed. It can be easily appreciated that this position will favor the flow of the fluid to the upper part of the vagina and around the cervix.

Hang the douche can with its lower opening not more than two feet above the level of the mattress. There are two important reasons why the can should not be higher, one has been already given, see page 341, the other is that the effect of heat is usually one of the most desired objects of the douche, and, if the solution is allowed to run in quickly, the parts will not be subjected to the treatment long enough to get full benefit, unless so much solution is used that the giving of the douche is greatly complicated.

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the patient for the douche, and it is only with care that the bed, etc., are prevented from being wet when the solution squirts from the many holes in the nozzle before it is inserted, this, for the douche may be done in the utility room. If there is any delay, however, the liquid in the tubing must be run out before the nozzle is inserted. To do this hold the nozzle over the dressing basin and only release the stop-cock to a slight extent.

Turn the nightgown out of the way.

Flex the patient's knees and place her feet firmly on the bed.

Put a folded towel on the shelf of the pan, keeping it away from the inner ridge where it will get wet.

Put one hand under the patient's buttocks and help her rise; place the pan under her with the parts that are to be douched over the opening of the pan. Put the pillow against the back ridge. A rubber is sometimes placed under the pan, but this makes it more difficult to move the pan and it is not necessary for only through carelessness will the bed become wet when giving a douche.

Wash[1] the external parts with the gauze sponges and do not let your fingers come in contact with the former while doing so.

Separate the labia. If there is any visible discharge remove it with sponges.

Insert the nozzle, gently, beyond its holes, slanting it backward, start the current.

From time to time, move the nozzle in the vagina so that all parts of the cavity and the external wall of the cervix will be subjected to the solution.

Shut the stop-cock before the solution reaches the exit of the reservoir. Remove the nozzle. If the patient has a purulent discharge, put the tip in the bag with the soiled sponges and be sure that it touches nothing else until it is sterilized.

[1] If the douche is given following delivery or operations on the genitalia, it will be necessary for the hands to be thoroughly scrubbed and disinfected and gloves put on before doing this. For the patient's sake, if possible, there should be a nurse to prepare her while the other nurse, having prepared the equipment, again disinfects her hands in preparation for giving the douche.

Dry the patient thoroughly.

Steady the pan with one hand while with the other you help the patient rise from the pan. Dry her back with the towel if necessary.

Remove the pan.

Make the patient comfortable. She should remain quiet, in the recumbent position (with one or two pillows under her head, if desired) for at least an hour after the treatment.

Remove the apparatus and care for the various articles as described in Chapter I.

Demonstration 65

Intra-Uterine Douches

This treatment, except in emergency, is given by the doctor, for it is not an easy matter to insert the nozzle into the uterus and, if the uterus is in a diseased condition, its walls might be punctured by unskillful manipulation of the nozzle. Thus, as a rule, the nurse's duties consist in preparing the patient and apparatus and being ready to assist the physician as required.

The points to be especially remembered are:

To maintain the strictest asepsis, for the slightest break may be followed by disastrous results.

To cleanse the vagina as though preparing for operation on the genitalia.[1] This includcs a vaginal douche.

To arrange for thorough illumination of the vagina.

[1] An exception to this may be made in case of hemorrhage following parturition, see page 348.

To have the temperature of the solution accurate. The usual prescription is 118° to 120° F.

To prevent the entrance of air into the uterus by (1) forcing it from the tubing before inserting the nozzle in the vagina, and (2) shutting off the current before the solution reaches the lower opening on the reservoir. This is particularly important following parturition as then air can very easily be forced into uterine blood-vessels.

Equipment: (The articles required for the preliminary cleansing and vaginal douche should be kept separate from those needed for the intra-uterine irrigation.) The former are the same as those used for the preceding demonstration minus the douche pan, if the patient is placed on the Kelly pad for the douche, as she usually is if it is given just before the intra-uterine one, and plus:

1. Sterile dressing forceps.
2. Laparotomy stockings.
3. A sheet.
4. A Kelly pad and pail.

For the intra-uterine douche there will be needed:

1. The irrigator containing the solution[1] with tubing, supplied with a stop-cock, attached.

2. A bi-valve speculum, this, after being sterilized, is generally placed in a sterile dressing basin containing lysol solution ¼%, this serves to lubricate the speculum.

3. Dressing forceps.
4. An intra-uterine douche nozzle.
5. Scissors.

[1] The solutions used must be prepared with sterile water. Acetic acid 1:50 is very commonly used to check hemorrhage and normal saline for other purposes.

6. A tube of sterile gauze packing.
7. Gauze sponges.
8. Four sterile dressing towels other than those required for covering the apparatus and tray.
9. Sterile apron and gloves for the doctor and one assistant.
10. Unless there is a good light, an electric drop-light.
11. A Chase doll for subject.

Preparation of patient[1]: As a rule, in a hospital, the patient is placed on the table used for gynecological treatments. If this is not used, unless the patient is in bad condition or is having a hemorrhage, when moving her might be dangerous, she should be placed athwart the bed and arranged as described on page 276.

Except in emergency, put on laparotomy stockings. Drape the sheet around the patient as described page 280, and cover her chest with a folded blanket.

Place the Kelly pad under her and arrange its drain in a pail.

Wash the vulva with hot, sterile green soap solution, ¼% (hold the sponges used for the purpose with sterile dressing forceps), and follow the washing with a vaginal douche. All solutions, sponges, and apparatus with which they come in contact are to be sterile.

Surround the parts exposed with sterile towels. Avoid all unnecessary exposure.

As, for obvious reasons, it is not possible to teach

[1] There should, if possible, be two nurses to prepare for and assist with this treatment; one for sterile and the other for unsterile work.

this treatment further than the preparation for it, by demonstration, nurses must pay special attention when assisting doctors so that, if an emergency arises, they will be prepared to give it. The most probable necessity for nurses doing so will be to check hemorrhage following parturition and then, as the cervix is dilated, it is comparatively easy to give the treatment, though the dangers of injury to the uterus, infection and driving foreign matter, as blood-clots, into the tubes, is as great as at any other time and in addition, there is the peril, unless care is taken, of forcing air into the uterine vessels and thus causing death by embolism.[1]

To obviate these dangers: 1. Use absolutely no force when introducing the nozzle. Direct it so that it goes backward at first and then forward. The reason for this will be seen by looking at Fig. 29. When the cervix is dilated, a vaginal douche nozzle can be used if necessary.

2. Hang the reservoir with its lower opening not more than twelve to eighteen inches above the mattress.

3. Be most careful of your aseptic technique; if there is hemorrhage there may be no time for the preliminary cleansing of the vagina, but, as the parts will have been prepared for delivery, this will not be as necessary as usual.

4. Guard against the entrance of air as directed on page 342.

Massage the abdomen over the fundus with one hand while you give the douche.

The after-treatment of the patient is the same as following a vaginal douche.

[1] Why can embolism be caused in this way?

Demonstration 66

Nasal Douche

In a nasal douche the fluid is introduced through one nostril and flows around the septum and out through the other nostril and the mouth. Thus all the interior of the nasal cavities and the naso-pharynx are subjected to its influence.

N. B. *If the treatment is not given properly infection of the sinuses in the frontal, maxillary, and ethmoid bones or of the middle ear may result.*

The common reason for transmission of infection to the sinuses from this cause is the too forceful striking of the liquid against the walls of the nostrils and this is generally the result of the irrigator being hung too high or of the too forcible injection of the liquid with a syringe or atomizer.

To understand how trouble in the middle ear can result from a nasal douche, it must be remembered that there is a small canal—the Eustachian tube—extending from the middle ear to the throat. Infective matter can be easily washed into these tubes if the liquid enters the throat from the nose under too great pressure or if the patient coughs or swallows during the process.

Coughing will almost surely occur during a douche if an irritating solution is used or if fluid gets into the trachea, and a cold liquid is very provocative.

Therefore, the solution should be about 110° F. and alkaline.[1] A solution very commonly prescribed is bicarbonate of soda and sodium chlorid a.a. one dram to a quart of water.

[1] This is also necessary to prevent irritating the mucous membrane.

Flexing the head forward, with the chin upon the chest helps to prevent liquid entering the trachea.

The reason that swallowing facilitates the passage of virus into the Eustachian tubes is that during this act the pharyngeal openings of the tubes become dilated to admit air to the middle ear, and a stream of liquid coming from the nose can then readily enter.

Equipment: 1. An irrigator stand.

2. The solution; this is usually in an irrigator[1] to which tubing, provided with a stop-cock, is attached.

3. A nasal tip. This can be dispensed with in emergency. In which case, the end of the tube is inserted in the nostril and the latter pressed upon to prevent the escape of liquid through that nostril.

4. A thermometer.
5. A basin to catch the liquid.
6. A table on which to rest the basin.
7. A small rubber.
8. A towel.
9. A safety pin.
10. A gauze handkerchief.
11. Subject.[2]

Procedure: Pin the towel around the patient's neck and give her the handkerchief.

Place the table in front of her, cover it with the rubber and put the basin on it.

Hang the irrigator with its lower opening about twelve inches above the patient.

[1] A syringe is sometimes used, but the irrigator is usually preferred because with it the force of the flow is more easily regulated and the pressure of the current is more uniform.

[2] Some of the pupils should be subjects for this and the following demonstrations of douches, for to know what these treatments feel like will give a better idea of how to administer them than can be conceived by any description.

Let some solution run through the tubing into the basin.

Have the patient lean forward over the basin, with her head flexed on her chest and tilted to one side with the nostril into which the tip is to be put higher than the other. Tell the patient to keep her mouth open, to breath through it, rather than her nose, and not to swallow. If the patient is old enough and not too ill, it is often better to let her hold the tip as she can then check the flow when it irritates her. If you hold it, tell her to give you a sign, as raising her hand, if she must cough or swallow (she should not attempt to speak) and check the flow as soon as she does so.

If one nostril is known to be more obstructed than the other, *e. g.*, following operation on one nostril, introduce the nozzle into the other nostril first, for the clots, etc., will be more readily washed out in this way. When the patient is not in bed, the tip is usually changed from one nostril to the other, but, as a rule, it is not necessary to make this change if the patient is in bed and cannot sit up for the treatment.

If the patient is in bed and not well enough to sit up, have her lie on one side with the nostril in which the tip is to be inserted uppermost and have her head flexed on her chest. Protect her chest and the bedding adjacent with the rubber, covered with the towel, place the basin where it will catch the return flow and proceed in the same manner as when she is up.

Demonstration 67

Pharyngeal Douche

Pharyngeal or throat douches are most frequently used (1) in preparation for operation upon the throat

and (2) in suppurative conditions of the throat, especially when, for any reason, the patient cannot use a gargle effectively.

Equipment: 1. An irrigator stand.

2. An irrigator, containing the required solution,[1] to which tubing supplied with a stop-cock is attached.

3. A tip; a curved drinking tube is generally used. This is omitted if the patient is a child and in this case a tongue depressor and sometimes something to put between the teeth will be required. A small spool or a cork is a good substitute for a mouth gag for the latter purpose.

4. A small rubber.

5. A dressing towel.

6. A basin.

7. A gauze handkerchief.

Precautions: The essential precaution in giving this treatment is to prevent the solution, and with it the discharge, being swallowed or getting into the trachea. Therefore, the head is to be well flexed upon the chest, and the current stopped, temporarily, from time to time, if the patient feels that she has to swallow; the entrance of fluid usually excites the desire to do so.

Procedure: Hang the irrigator about two feet above the mattress.

Turn the patient on her side and have her lie with her head flexed on her chest and her face tilted downward.

Put the rubber covered with the towel across her chest and on the bed and the basin where it will catch the return flow.

[1] Solutions commonly used are: Boric acid two per cent.; normal saline; sodium bicarbonate one per cent. The temperature of the solution is generally between 100° and 110° F.

Insert the irrigation tip in the upper corner of the mouth and, with it, press down the back part of the tongue so that the fluid will reach all parts of the throat. Move the tip from time to time, but be careful not to let it touch the back of the throat for doing so will cause gagging.

Demonstration 68

Aural or Ear Douche

It is the auditory canal that is irrigated in the ordinary ear douche, but the treatment is used, not only for pathological conditions of the canal, but also for those of the middle ear, because the heat is often of great value in relieving pain and inflammatory conditions in the latter.

Important facts regarding the auditory canal to bear in mind when giving a douche are: That the canal, in the adult, is about one and one quarter inches long and somewhat shorter in children and is divided from the central portion of the ear—usually termed the *middle ear*—by a membrane called the *tympanum* or *drum*. The exterior two fifths of the canal is of cartilage, but its posterior portion is hollowed out of the temporal bone. The canal, after the first two or three years of life, curves first upward and then downward, its highest point being just about at the juncture of the cartilage and bone. For this reason, when giving a douche, it is necessary to pull the auricle upward and backward. This, as the cartilage foundation of the auricle is continuous with that of the canal, pulls the latter up above the floor of the highest portion of the canal.

In children under about two years of age, owing

to imperfect development of the temporal bone, the central elevation in the canal is lacking and, therefore, when giving an irrigation, the auricle must be drawn downward and backward.

Precautions necessary in douching the ear are: (1) To avoid making pressure on the drum as this will produce pain and might even cause a puncture. (2) To avoid irritation of the canal by the use of unsuitable solutions or by rubbing it. Irritation will not only cause pain at the time, but it is likely to excite a chronic excessive secretion of cerumen or furunculosis.[1] (3) To have the solution the right temperature. Between 106° and 110° F. is the temperature commonly prescribed; anything colder than this may, when there is inflammation, induce pain that will persist for hours.

Equipment[2]**:** 1. The solution, between one and two pints (normal saline and boric acid are very commonly prescribed), in, preferably, an irrigator,[3]

[1] See glossary.

[2] When a douche is given following an operation on parts in or around the ear, the equipment must be sterile. Otherwise everything must be surgically clean but only the nozzle and the solution need be sterilized.

[3] These have several advantages over the bulb and the piston syringes often substituted: (1) When they are used the flow of solution can be so regulated that the interior of the canal will be filled during the entire treatment, but without undue pressure on the drum, for the rate of the entrance and exit of the liquid will be uniform and balanced, which is not the case with the syringes; (2) it is easy to keep the bedding or clothing from becoming wet, and with the syringes and a straight irrigator tip it is only possible to do so by keeping a basin pressed uncomfortably tightly against the neck under the ear because these cannot be fitted into the entrance of the canal, it being necessary to leave space there for the exit of the fluid.

to which rubber tubing of one quarter inch bore is attached. Have a stop-cock on the tubing.

2. A nozzle[1]; the *return flow aural irrigating tip* and the Fowler's *ear irrigator tip* are considered the best kinds. Attach about eighteen inches of rubber tubing one quarter inch bore to the projection for the return flow. See Fig. 33.

3. A small rubber.

4. A dressing towel.

5. A basin large enough to hold the amount of solution used.

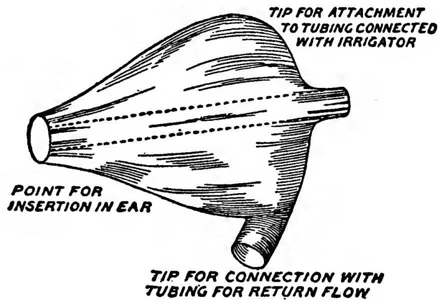

Fig. 33. Glass return-flow ear nozzle.

6. Absorbent cotton.

7. A receptacle for used pledgets.

Procedure: Hang the irrigator about two feet above the patient.

Have the patient, if in bed, in the dorsal recumbent position with the head turned slightly to one side, the ear to be treated being uppermost.

Place the rubber, covered with the towel, across the patient's chest and covering the adjacent bedding. Place the basin on the latter portion.

Put the tubing for the return flow in the basin, hold the nozzle over the latter, and let the solution run until all air is expelled and the tube is warmed.

Check the flow. Insert the nozzle in the ear. Hold the auricle as directed on page 353. Let the solution run.

[1] See note 3, p. 354.

If pain or dizziness is occasioned, lower the reservoir, for this usually results from too much pressure. If the symptoms continue, stop the treatment until you have notified the doctor.

Shut off the current before the solution reaches the lower exit of the irrigator.

Remove the basin, etc. Dry around the ear if necessary.

Make small cone-shaped pledgets of absorbent cotton an inch to one and a half inches in length and place one point foremost in the ear. Change it in a minute or two and continue to do this until the ear is dry.

When douching the ear for the purpose of washing out a foreign substance, use a plain irrigator tip or else a bulb syringe and do not close the opening of the ear. If the matter to be removed will swell if wet with water, use alcohol fifty or seventy per cent.

Demonstration 69

Eye Douches

Important precautions to be taken when douching the eyes are: (1) Not to let the tip of the syringe, if one is used, touch the eye; (2) to avoid pressure upon the eyeball; (3) not to direct the current toward the nose for, by so doing, discharge may be washed into the lacrimal canals and nasal duct, and serious trouble result; (4) not to use anything rough, as gauze, for wiping the eye—absorbent cotton is particularly good for the purpose; (5) to be very careful to have the percentage and temperature of the solutions accurate, for the cornea is very sensitive and

easily irritated. Sterile water and boric acid solution two per cent. are very commonly used for cleansing douches and the temperature is usually between 100° and 105° F.

Equipment[1]: 1. A dressing basin containing one half to one pint of the solution, and either absorbent cotton pledgets or a bulb syringe.

2. Dry absorbent cotton pledgets; the number required will depend upon the amount of discharge present.

3. A small rubber.

4. A dressing towel.

5. An empty basin.

6. A receptacle for used pledgets.

7. Rubber gloves if the treatment is given following operation or if there is a purulent discharge.

Procedure: Have the patient lie with the head thrown back and tilted so that the eye to be treated is slightly lower than the other in order to avoid washing discharge into the latter. If there is a purulent discharge protect the unaffected eye with a Buller's shield or an improvised substitute (see page 359).

Arrange the rubber, covered with the towel, so that it will protect the clothing or bedding and place the empty basin where it will catch the escaping solution.

Wash off any adherent discharge from the lids with pledgets moistened with solution (never put a used pledget back into the solution).

[1] When the treatment is given following operation or injury associated with abrasion, everything used for the treatment, except the protecting rubber and the receptacle for the pledgets, must be sterile; otherwise they must be scrupulously clean, but need not necessarily be sterilized.

Separate the lids[1] by making traction with the thumb and first finger of the left hand upon the flesh above and below the lids, exerting all necessary pressure while doing so upon the frontal and malar bones,[2] *never on the eyeball.*

Squeeze the solution over the eye from the syringe or pledgets, taking the precautions mentioned on page 356, and do not let the current fall with force upon the eyeball. During the treatment have the patient at times look, alternately, upward and downward, by moving the eyeball, not the head.

At the conclusion of the treatment dry the eye by very gently patting with a pledget and dry the face with the towel.

A douche with an eye-bath: This form of douche can be used only by adults and children who are old enough to manipulate the bath as directed. It is not suitable for use when there is suppuration.

Equipment: 1. An eye-bath, about three quarters full of the prescribed solution. (The eye-bath is a small oval cup that will fit around the eye.)

2. A towel and safety pin.

Procedure: Pin the towel around the patient's neck, give her the cup and instruct her to (1) bend her head forward and press the cup firmly around the eye, keeping the eye closed while doing so, and (2) pressing the cup in place, to throw her head backward and, for the length of time prescribed, which is usually

[1] If the eye is very much swollen it will be necessary to raise the upper lid with a lid-retractor, but, unless a nurse has had special training in the treatment of the eyes, she should not attempt to do this until shown how by the physician, for unless it is done properly serious damage may be done.

[2] The pupils should practice doing this on themselves.

two to five minutes, to keep alternately opening and closing her eye and moving the eyeball. (3) to bend her head forward and remove the glass.

To improvise a Buller's shield for the protection of one eye when the other is diseased:

Take a watch crystal, about 1½ inches in diameter, and two pieces of adhesive plaster, one 2½ and the other two inches square, make a hole one inch square in the center of the smaller piece and about half an inch to one side of the center in the larger piece. Paste the smaller piece of plaster to the margin of the concave side of the crystal and the larger to the convex side and the two pieces of plaster to each other. The larger piece will extend half an inch beyond the smaller except at one side. Place the crystal over the eye, concave side downward, with the side where there is no free adhesive material at the outer side of the face. Stick the adhesive to the face above and below the eye and around the nose. It is left free at the temporal side of the face to allow for ventilation of the eye. If the shield is to be worn continuously, it should be removed twice daily and the eye washed. Never use anything that is used for the other eye for this purpose.

CHAPTER XI

Catheterization and Bladder Irrigation

Reasons for catheterization. Precautions necessary when passing the catheter. Technique of passing the catheter on (1) a woman, (2) a man. Expedients that can be tried to cause voluntary micturition. Purposes and technique of bladder irrigation. Catheterization of the ureters.

By catheterization is meant the removal of fluid from a body cavity. The term is used more especially in connection with the withdrawal of urine from the bladder or ureters.

Demonstration 70

Catheterization of the Bladder

Catheterization of the bladder is resorted to when for any reason there is undue retention of urine in the bladder. How long it will be safe to allow a patient to go without voiding urine will depend upon several factors. Following parturition or operation

NOTE.—Even though the treatments described in this chapter can be but very imperfectly demonstrated in class it is well to carry out the procedures using the hospital doll for the subject, for this will lessen the amount of instruction necessary when the pupils give the treatments and the necessary precautions and other essential information can be better explained in class than as the bedside.

on the uterus a bladder that is all distended might cause trouble and therefore, for the first day or two following operation the catheter is generally passed about every eight or ten hours, if urine is not voided normally, otherwise, unless the bladder becomes distended, it is usually only done about every twelve hours, but this is for the doctor to decide. Women are also catheterized when a sterile specimen of urine is wanted, preceding operations on the pelvic organs and, sometimes, following perineorrhaphy, in the first case because the urine becomes contaminated in its passage through the vagina, in the second, because if the bladder is at all distended it might be punctured, and in the third to avoid irritation or infection of the stitches.

Conditions particularly likely to cause retention of urine are: Depression of the nervous system—as when a patient is suffering from shock or is in collapse and following anesthesia—and nervousness. The ingestion of a small amount of water and profuse perspiration or loss of fluid from the body from other cause are conducive to retention because the secretion of urine is then lessened and, naturally, if there is little urine in the bladder the stimulus which promotes micturition will not be excited.

Even a slight break in the correct technique of catheterization may result in cystitis, a condition that is very hard to cure and that may cause great suffering; therefore, as a rule, **means to induce the patient to urinate naturally** should be tried before passing the catheter. Means in common use are:

NOTE.—What term is applied to the condition when the kidneys fail to secrete urine? What to that in which there is a constant passage of small quantities of urine, but failure to evacuate the bladder? See page 574.

Placing the patient on a bedpan and pouring hot water over the vulva, applying hot compresses or a hot-water bag over the pubes and, if the patient is near a bathroom letting the water run from the faucet (the last-mentioned procedure is generally only of use if the retention is due to nervousness), supplying the patient with a liberal amount of liquid.

Precautions necessary when passing the catheter are: Maintain the strictest asepsis.

Do not touch the catheter near the end that is to be inserted nor let it come in contact with anything unsterile, *e. g.*, the labia.

Examine a glass catheter before inserting it to see that it is intact, for glass is often cracked during sterilization.

Do not use a glass catheter for a pregnant, delirious, or unconscious patient, nor a child.

Never use force when inserting the catheter.

Instruct the patient to avoid straining during catheterization if, as is frequently the case, she attempts to do so.

If the bladder is much distended do not remove more than 600 c.c.; sudden collapse of a distended bladder being injurious to the organ.

Equipment[1]: 1. A sheet and, if the ward is cold, a shoulder blanket.

2. A small rubber.

3. A dressing towel.

4. A receptacle for the used sponges.

On a scrubbed tray that is covered with a sterile towel:

[1] In addition to the catheters needed to demonstrate the process of catheterizing, different kinds should be on hand—*e. g.*, glass, rubber silk, self-retaining and a Y or return-flow catheter.

1. Two or three catheters[1] sterilized as described, page 101. In some hospitals the catheters are brought to the bedside in the utensil and water in which they are sterilized; in others, they are transferred from the sterilizer, *with sterile forceps*, to a basin containing boric acid, or they are put between the folds of a sterile towel.

3. A sterile basin containing the solution[2] for cleansing the vulva, and six sterile pledgets.

4. Sterile forceps.

5. Two sterile towels in addition to those used to cover the tray and the sterile utensils.

6. A sterile basin for the reception of the urine or, if a specimen is required, two will be needed.

7. Sterile gloves.[3]

8. If a rubber catheter is used, sterile glycerine or oil.

Cover these with a sterile towel.

Procedure: Replace the bed covers with the sheet, placing the latter lengthwise across the bed, put the blanket over the patient's chest.

Have the patient, if possible on her back though the treatment can be given, if absolutely necessary with her on her side.

Flex the patient's knees, raise her slightly and put

[1] Two, and if there is likely to be trouble in finding the meatus as following parturition, three catheters are prepared in case one should be rendered unsterile before it is inserted.

[2] Either boric acid 2% or biniodid of mercury 1:5000 is very commonly used. The solution should be warm.

[3] In some hospitals the nurses are always required to wear gloves when catheterizing. In others, this is only considered necessary if a rubber catheter is used, because, with the glass catheter it is not necessary to touch it higher than the bend and this does not enter the vulva.

the rubber, covered with a dressing towel, under her for about two inches.

Draw the sheet up in the center to the pubes and drape the ends around the legs.

Place the table holding the sterile utensils where you will be able to reach everything easily with your right hand.

Scrub and disinfect your hands as carefully as though preparing for a surgical dressing and, if the rules require it, put on the gloves.[1]

Place the sterile towels over the sheet, one on either side around the vulva and with them, using your left hand, draw back the sheet so as to adequately expose the vulva.

Place a basin on the bed against the vulva, with your left hand.

Take a sponge with the forceps, squeeze excess solution from it by pressing it against the inside of the basin. Separate the labia with the thumb and first finger of the left hand; wash down over the meatus toward the anus, making as much pressure as possible without causing discomfort. Do this four times, using a clean sponge each time. Take a fifth sponge and place it between the labia just below the meatus.

If a sterile specimen of urine is required and there is any solution in the basin, change this basin for the other one that was prepared for the purpose.

Take the catheter in your right hand. If it is of

[1] Whenever it is possible there should be two nurses for this treatment and one should prepare the patient while the other is scrubbing her hands, for it is very annoying for the patient to wait after she has been prepared.

glass[1] hold it at the bend and examine it carefully to see that it is intact. With the open end pointing upward, insert it, gently, in a slightly backward[2] direction holding it loosely so that it will turn in accordance with the shape of the urethra until the open end points downward (it will do this with very little guiding). Cease moving the catheter as soon as the urine begins to flow, but if the current ceases before as much is passed as you expect, introduce the catheter, very gently, a little further.

When no more urine passes, put your finger over the open end of the catheter—to prevent that remaining in the latter dripping in the bed—and remove it.

Remove the basin containing the urine.

Remove the sponge that you placed between the labia. Wash the vulva with a moist pledget and dry the parts with a sterile towel.

Make the patient comfortable and remove the apparatus.

Measure the urine and record the amount obtained.

Insertion of a Self-Retaining Catheter

Sometimes it is necessary to leave a catheter in the bladder in order to keep the latter empty and, as a rule what is known as a *self-retaining catheter* is

[1] If a rubber catheter is used, wear a sterile glove and hold the catheter two inches from the point between your thumb and first finger with the remainder of the open end, except the opening, in your hand. Lubricate the end to be inserted by dipping it into the sterile glycerine or oil.

[2] The urethra through which the catheter is passed into the bladder is, in the adult female about one and a half inches in length and, in the male eight to nine inches. The shape of the urethra and bladder can be seen in Fig. 29.

then used. This type of catheter is of rubber and has a round or oval hollow projection about half an inch below the point of the end that is introduced into the bladder. When inserting such a catheter the projection must be obliterated; this, if the patient is a woman, is most easily done by stretching the self-retaining catheter over a small glass one and, for a male patient over a large blunt-end probe or applicator.

Catheterization of a Male Patient

Requisites: These are the same as for a woman patient except that a curved glass catheter is never used. Those that are used, generally either rubber or silk, require a lubricant—this is commonly either sterile oil or sterile glycerine.

Procedure: It is a rare thing for a nurse to be obliged to pass a catheter upon a man but she should have some idea how to proceed, in case of emergency. The technique is as follows: Raise the penis to an angle of about 60° from the body. Draw back the prepuce. Cleanse the glans with boric acid solution, then wrap a small piece of gauze around the corona. The gauze covers any secretions which may remain and prevents the prepuce from slipping back over the glans. Hold the penis with the second and third finger of the left hand; separate the lips of the meatus with thumb and forefinger and cleanse them. Oil the catheter, and introduce it slowly until an obstruction is met, which will generally occur even in the normal urethra when the catheter has passed in about six inches. Wait fully a minute, then make gentle pressure, and the catheter will readily enter the

bladder. A medium size or large catheter is passed more readily than a small catheter in normal urethras.

Demonstration 71

Irrigation of the Bladder

This treatment is used for the same purposes as the douching of other mucous-lined cavities. See Chapter X.

Solutions commonly used for cleansing purposes are sterile normal saline and sterile boric acid 2%; and, for disinfection, potassium permanganate 1:-1000, silver nitrate 1:1000–1: 2000 and protargol 1:1000.

The temperature usually prescribed is between 100° and 106° F.

Method 1. Equipment: The articles required for catheterization, but a return-flow or Y catheter will be needed and one of the empty basins must have a capacity of at least one quart, and, in addition, there will be needed:

1. The solution (about one quart is generally prescribed) in a sterile graduated glass irrigator, to which is attached sterile rubber tubing, of one fourth inch bore, provided with a clamp.
2. A piece of sterile rubber tubing, one fourth of an inch bore, eighteen inches long, provided with a clamp.
3. An irrigator stand.

Procedure: Hang up the irrigator about twelve inches above the patient.

Catheterize the patient as already described. Leave the catheter in place. Remove the basin

containing the urine and replace it with the empty one.[1]

Let solution run through the tubing connected with the irrigator until all air is expelled from it.

Attach the irrigator tubing to the upper projection of the catheter and the other piece of tubing to the lower projection, see that the clamp on the latter is closed, put the free end in the basin.

Open the clamp of the irrigator tubing and let one half pint or more (up to three fourths of a pint[2] if distress is not caused) run slowly into the bladder, then open the clamp of the tubing for the return flow; the solution should now flow in a continuous stream into and out of the bladder, but, there will be about half a pint of solution remaining in the bladder because of the restriction of the return flow at the beginning. The need for this is twofold: (1) That the walls may be bathed with solution, as they will not be unless the bladder is somewhat distended with solution; (2) to prevent the inflamed bladder walls coming in contact with the catheter which might still further irritate them.

Shut the stop-cock on the irrigator tubing before the solution reaches the exit of the reservoir. Let all the solution flow from the bladder. Remove the catheter and finish the treatment as when catheterizing the patient.

Method 2. Equipment: The same as for Method

[1] Especially if there are not two nurses for this treatment these basins and the clamps on the tubing must be sterile.

[2] In health the bladder will hold a pint without discomfort, but when it is inflamed this may not be possible and, as irritation is to be avoided, not more than half should be given if it causes discomfort.

1 with the following exceptions: Have rubber[1] catheters, instead of the Y; insert a sterile glass connecting tube in the free end of the irrigator tubing; no extra piece of tubing for the return flow will be needed; the dish to receive the return must be graduated[2] or a sterile glass measure that will hold about half a pint can be put in the basin and emptied as required (a large measure would be too tall for the purpose).

Procedure: This will be the same as for Method 1 with the following exceptions: After between half and three fourths of a pint of solution has entered the bladder, check the flow[3] and disconnect the catheter from the connecting tube—being very careful while doing so not to allow the catheter to move in the bladder and allow about half of the solution injected to return[4]; then check the flow[4] and reconnect the tubing; allow as much solution to enter as was returned and then disconnect the catheter as before. Repeat the process until the solution returns clear or the desired amount has been given.

Method 3. Equipment: The same as for Method 1 with the following exceptions: Have rubber catheters; have the solution in a sterile graduated measure;

[1] Rubber catheters are to be preferred to glass for this purpose because the latter move too easily in the bladder when connected and disconnected.

[2] A glass dish can be easily marked for purposes of this kind by pouring in for example, half a pint of water and marking the level with a file or oil paint, adding another half a pint of water and marking this level and so on.

[3] Do this by making pressure with the fingers.

[4] Some physicians prefer to have the bladder completely emptied after each injection but others, for the reasons given under Method 1, do not wish this done, at any rate more than once during the treatment. It can be easily appreciated that the same solution does not stay in the bladder all the time.

instead of the irrigator and stand, have a half pint funnel to which attach the eighteen inches of sterile rubber tubing, insert a glass connecting tube in the free end of the tubing; the basin for the return solution must be graduated as for Method 2.

Procedure: After catheterizing the patient and changing the basins, fill the funnel with solution and, holding it as described, page 391, let about half of its contents flow through the tubing. Check the flow and insert the free end of the connecting tube in the catheter. Fill the funnel, raise it about ten or twelve inches and, as necessary, pour in more solution so that a slow steady stream will enter the bladder (*never allow the funnel to become empty*)[1] until between 250 and 300 c.c. (½ to ¾ of a pint) have been given then lower and invert the funnel over the basin and allow about one half the amount given to return[1], then quickly fill the funnel, raise it slowly and allow as much fluid as came out to flow in; then lower the funnel and allow this much to return. Repeat the process until the solution returns clear or the required amount has been given.

Catheterizing the Ureters

The ureters are catheterized for diagnostic purposes as in this way it can be determined whether or not both kidneys are diseased or not functioning properly or, if only one is affected, which one is at fault.

The operation is always performed by the doctor and the proceedings cannot be taught by demonstration nor very definitely described, therefore, the

[1] If air gets into the catheter it will interfere with siphonage.

following description is meant merely to give some idea of the nature of the operation and the nurses' responsibilities.

The nurses' duties consist in preparing the patient and the required utensils, keeping things sterile and making sure that the urine from the two ureters is kept separate and not mistaken one for the other. In order to prevent a mistake of this kind, the catheter used for each ureter and the glass intended to receive the urine from each one are marked right and left respectively and are kept separate and a nurse must read the marking as she passes the utensils to the doctor or as he takes them from the tray.

The preliminary preparation of the patient generally consists in, for a woman, cutting or shaving the hair around the parts. A nightgown, wrapper, and laparotomy stockings are usually worn, and, unless the patient is taken to the treatment room on a stretcher, slippers. The patient is placed on the table in the lithotomy position, the wrapper folded above the pubes so that it will be out of the way, and a sterile sheet is draped about the lower part of the body as described in Chapter VII. The local preparation consists in washing the vulva and its surroundings with (1) soap solution and hot water and (2) a disinfectant. Everything used for the purpose must be absolutely sterile. Following this, the bladder is catheterized and irrigated. This is usually done by the doctor just previous to passing the catheter into a ureter.

The articles needed in addition to those for catheterizing and irrigating the bladder will be: two silk elastic catheters and two large test tubes to receive the urine, marked as previously mentioned, a sterile

lubricant for the catheter, whatever anesthetic the doctor requires and the means for giving it, sterile gown and gloves for the doctor and assistant.

Needless to say, everything used for the purpose must be absolutely sterile. The cystoscope can be prepared by washing it with green soap and water and letting it stand in a disinfectant such as formalin 4%, or carbolic 20%, or alcohol 75% for at least, half an hour and, just before it is needed, put it into boric acid 2% or sterile water, the methods of sterilizing the other articles have been already described.

CHAPTER XII

Treatments Used to Supply the Body with Fluid

Results of deficiency of water in the system. Common causes for deficiency. Ways in which extra fluid can be supplied. Protoclysis. Enteroclysis. Intravenous infusion. Hypodermoclysis. Transfusion.

Animal life will succumb more readily to lack of fluid than to lack of food, because (1) water is such an essential constituent of protoplasm that any considerable decrease is quickly followed by changes that are inimicai to life. This is shown by the rapidity with which plants die when they are left without water. (2) If the deficiency of body fluid is at all marked, the quantity of blood will be diminished and this, with other conditions produced, will entail a fall of blood pressure that will interfere with normal circulation. (3) Reduction of fluid in the body will be followed by lessened elimination of urine and the accumulation of toxic substances in the body. Therefore, when for any reason there is a lack of fluid in the body or when, for purposes that will be mentioned later, an extra amount is necessary, supplying a liberal quantity is one of the most important therapeutic measures.

Deficiency of fluid in the body may be due either to lessened intake or to excessive loss. The more

common causes of loss are: Diaphoresis; diarrheal disturbances or the taking of hydragogue cathartics; hemorrhage; bloodletting, such as is occasioned by surgical operations; and accumulation of blood in the veins, such as occurs when there is a decided fall of blood pressure.[1]

A liberal supply of fluid is particularly essential when: (1) There has been a loss of fluid, (2) there are toxic substances in the body, either (a) those formed within the body by bacteria or defective metabolism; (b) those absorbed as, for example, in poisoning by drugs; (c) those accumulating within the body as the result of imperfect elimination by the kidneys. The giving of extra water in this condition, however, will be contraindicated if the kidneys are not eliminating water properly, this will be shown by the presence of edema.

The ways in which water can be supplied are: (1) By increasing the amount given by mouth; (2) by the treatments classified by some writers as *infusions;* (3) by the transfusion of blood.

The so-called infusions include: (1) The injection of fluid into the rectum by the methods known as *protoclysis* and *enteroclysis;* (2) the injection of fluid directly into a vein—i. e., *intravenous infusion;* (3) injection into the cellular tissue, commonly known as *hypodermoclysis.*

It can be readily appreciated that when conditions necessitating a large supply of fluid exist, it is likely to be impossible to give as much water as necessary

[1] Though, in this state, the amount of liquid in the body is not actually diminished, practically the same conditions exist as though it were. The reasons for this will be found in the sections on the pulse and shock.

by mouth. This is especially the case in the following conditions: When the patient is in shock; following hemorrhage; when there is nausea, peritonitis, or intestinal obstruction.

In the two conditions last mentioned the giving of water by mouth has to be exceedingly limited because water, unlike food, is absorbed chiefly from the large intestine and only to a small extent from the small intestine and not at all from the stomach. Therefore, if there is any obstruction to its passage into the large intestine, as there will be in both peritonitis or intestinal obstruction, the water increases vomiting and, especially when peritonitis exists, this is to be avoided, since the muscular contractions thereby promoted hasten the absorption of the lymph containing toxic matter into the general circulation. This was discussed under Fowler's position.

The more important uses of infusions are: 1. To supply the body with fluid when it cannot be taken in sufficient quantities by mouth.

2. Stimulation of the circulation. This is brought about chiefly by increasing the amount of blood in the vessels, thus causing a rise of blood pressure and, thereby, forcing the heart to take a stronger contraction.

3. Stimulation of the functioning of the kidneys. This is due to (a) the rise of blood pressure, (b) the dilution of the blood.[1]

4. Dilution of toxic material contained in the body.

5. Prevention or inhibition of injury to the kidneys

[1] The blood always tends to maintain a certain degree of concentration and the kidney capillaries are the vessels by which it, normally, gets rid of excess fluid.

by diluting the irritating poisons which they are eliminating.

Demonstration 72

Protoclysis or Murphy Drip[1]

This treatment consists in the slow introduction of fluid into the intestine in amounts that can be readily absorbed and the aim of the technique is to guard against all irritation of the bowel, for irritation will at once promote intestinal contraction and the consequent expulsion of the fluid.

In order for the treatment to be successful, the technique must be perfect, and failure is almost always the result of either ignorance or carelessness on the part of the one giving the treatment.

To avoid irritating the intestine it is necessary: (1) To use a liquid that will not irritate the intestine; (2) to have the fluid about the same temperature as the body (100° F.); (3) to prevent distention of the bowel by (a) providing means for the escape of gas, unabsorbed water, etc., from the intestine, (b) to regulate the height of the reservoir containing the liquid for the treatment, so that the latter, on entering the intestine, will not induce a pressure exceeding a four-inch hydraulic pressure[2] or, when abdominal inflam-

[1] So-called after Dr. John P. Murphy one of the first men to advocate this method of giving water for the purposes mentioned above.

[2] The term *hydraulic* refers to fluids in motion and thus hydraulic pressure means the pressure exerted by fluid in motion. When the flow is controlled by gravity, the degree of pressure that it will exert is determined by the difference in the height of the outlet of the reservoir and the level to which the fluid

mation exists a five- to six-inch pressure. The reason for increasing the pressure when there is abdominal inflammation is that the inflammation increases the intra-abdominal pressure and to get the best results from the treatment the pressure of the contents of the bowel (including the water) and the tension upon the walls of the intestine are to be about equal. It can be easily appreciated that if gas or water is allowed to collect, or if there is feces in the lower part of the bowel, the intra-intestinal pressure will be increased and the bowel become distended. Therefore, as previously stated, free passage for gas and unabsorbed water from the bowel to the reservoir must be provided, and if there is any amount of feces present the doctor should be notified, unless there is a standing order to give an enema or rectal irrigation under such circumstances. When either of these are given, the protoclysis is usually discontinued for a short time until the peristaltic action induced by such treatments ceases.

There are two methods of regulating the flow of solution in common use: (1) By the height of the reservoir, this is very generally known as the *Murphy method* (as it was the one first described by Dr. Murphy) and the *gravity method;* (2) by the use of some form of apparatus that will regulate the flow so that the solution will enter the rectum drop by drop, three drops per second being the usual rate, this is generally referred to as the *drop method.*

Some nurses find the drop method easier to regulate,

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flows, which, in this case, is the rectum. Thus for a four-inch hydraulic pressure, the outlet of the reservoir is to be placed four inches above the rectum, for a five-inch pressure, five inches above the rectum.

but it has the disadvantage of requiring apparatus that is not always easy to obtain and thus the pupils should have experience in using the Murphy method, even though it is not the one in general use in their hospital.

Murphy Method

Requisites: 1. A reservoir[1] containing the required solution[2] and connected with rubber tubing of sufficient length to reach, without tension, to the patient's rectum. It is well to have a stop-cock on the tubing to control the flow until the nozzle is inserted in the rectum, but during the treatment it must not restrict the caliber of the tube in the least for the flow must be controlled by gravity alone, and never by constriction on the tube, so that when the patient endeavors to expel gas, etc., any unabsorbed fluid will at once pass back to the reservoir, otherwise it will cause distress and probably be expelled into the bed.

2. A stand for the reservoir.

3. A nozzle.[3]

[1] If possible this should be of glass and graduated so that the rate of the flow can be easily observed.

[2] This is usually either half strength normal salt solution, sodium bicarbonate solution 5%, or bicarbonate-glucose solution (a.a., q.s. for 5%). The last-mentioned solution is used more especially following serious operations, for the glucose provides nourishment and the soda helps to counteract the acidosis occasioned by the defective metabolism resulting from the effects of the anesthetic.

[3] Special nozzles for the purpose can now be bought, see that in Fig. 34. A good substitute is a medium-sized rectal tube, but most surgeons and physicians consider that catheters, which

4. A lubricant.
5. A heater.[1]
6. A thermometer.
7. Adhesive plaster.
8. A basin or pitcher.
9. A towel.
10. A soft pad.[2]

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are sometimes used, are too small in diameter to allow the free passage of material from the rectum. Douche nozzles with multiple openings, are sometimes used but these, if longer than three inches, and the patient is in Fowler's position, must be bent at this distance from the tip to almost right angles for, otherwise, they would press upon the wall of the rectum.

[1] There are a number of patented appliances to be had for this purpose and, also there are several different devices used as substitutes. One of the best of these is a hot-water bag with a thick flannelette cover that has a hole just the size of the rubber tubing in its lower end. The tubing is put in under the cover through the ordinary opening of the latter and is brought out through the hole in the bottom, thus it lies stretched across the length of, and directly in contact with, the hot-water bag. The hot-water bag is placed at the extreme edge of the side of the bed and is kept in place by tying the string which keeps the cover closed around the bar at the side of the bed. It is very important to secure the bag in place, because it must be kept as hot as possible and thus might burn the patient if it came in contact with her. A rather questionable, though frequently used, means of keeping the water hot is to suspend an electric light bulb in the top of the can. The objection to this is that if even a very small amount of water gets into the socket, the water, being a non-conductor of electricity, will oppose the current and thus generate so much heat and force that accidents may occur. Students who have not studied Physics should read the sections in a textbook of Physics dealing with the nature of electric lights and heating appliances.

[2] A soft pad of cotton-waste in gauze, about twelve inches square or a small rubber covered with a dressing towel are put under the patient. This should not be necessary, as there should

Procedure: Put the pad in place to catch any possible leakage from the rectum. The treatment can be given with the patient in any position.

Arrange the apparatus and *remember that the outlet of the reservoir is not to be more than four inches higher than the patient's rectum*, if the patient has peritonitis, the reservoir is to be raised an inch or two as required after a short time. (*It is so important for the height of the reservoir to be right that the pupils should measure the height with a ruler or other measure until they have given the treatment often enough to make an absolutely accurate judgment without doing so*).

Put the thermometer in the solution, see that the temperature is right, cover the top of the reservoir with a folded towel.

Expel the air from, and warm, the tubing by letting solution run from it into the basin or pitcher provided for the purpose. Constrict the tubing to shut off the flow.

Lubricate the nozzle and insert it into the rectum about three inches. Some types of nozzle have a rubber plug which retains it in place, if there is no such contrivance, take a strip of adhesive, about half an inch in width, put the central portion around the tubing, just beyond the nozzle, and secure the ends to the sides of the thighs in such fashion that it will hold the nozzle in position.

Do not start the flow for a few seconds, until the patient becomes accustomed to the presence of the

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be no leakage from the rectum, but, as accidents sometimes happen, it is well to be prepared, especially as, when the patient is getting this treatment, she is usually so ill that all unnecessary movement—such as will be entailed if the draw sheet must be changed—is to be avoided.

nozzle. Then open the stop-cock and do not close it again until the end of the treatment. Do not leave the patient for one moment until you are sure that everything is right. If this is the case, there will be no leakage around the rectum, and after a few minutes have passed there will be no discomfort.

About a pint of liquid will be absorbed within an hour or an hour and a half. A common prescription is that this amount should be given every two hours. The nozzle should not, as a rule, be removed between treatments as its constant removal and insertion produces irritation of the rectum. The periodical discontinuance of the flow for short intervals is to al-

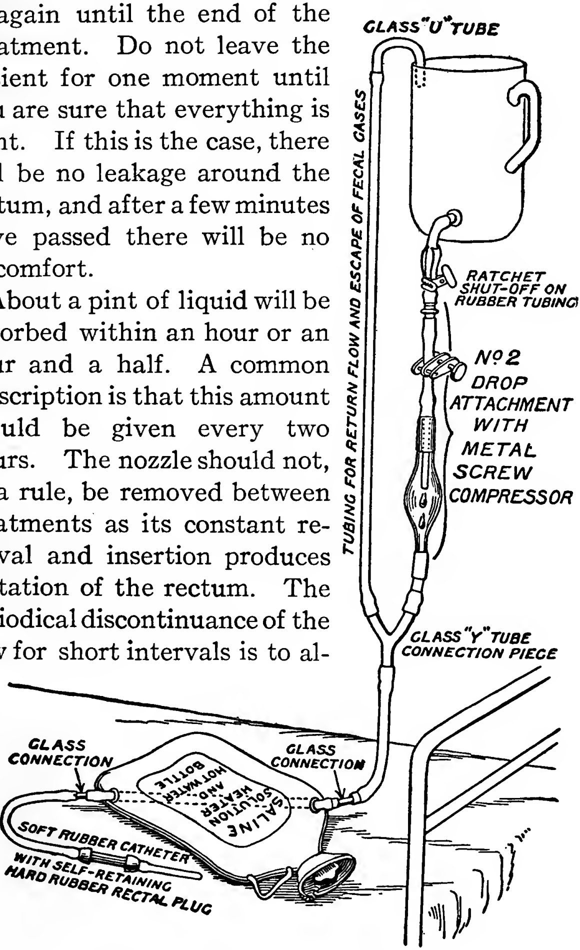

Fig. 35. Meinecke protoclysis outfit.

low of the reabsorption of fluid which transudes from the vessels after a considerable amount of liquid has

been absorbed. Before recommencing the treatment it is well to lower the reservoir for a time as this will encourage the evacuation of any unabsorbed fluid. If liquid is expelled empty the reservoir before filling it with the fresh solution.

Notice and record if gas is, or is not, expelled during the treatment.

Drop Method of Protoclysis

The essential points of difference between this and the Murphy method are: (1) the flow of solution is regulated so that it enters the intestine drop by drop at the rate of about three drops per second and (2) provision is made for the back flow from the rectum as it will not be able to pass the restriction regulating the inflow.

Two appliances commonly used

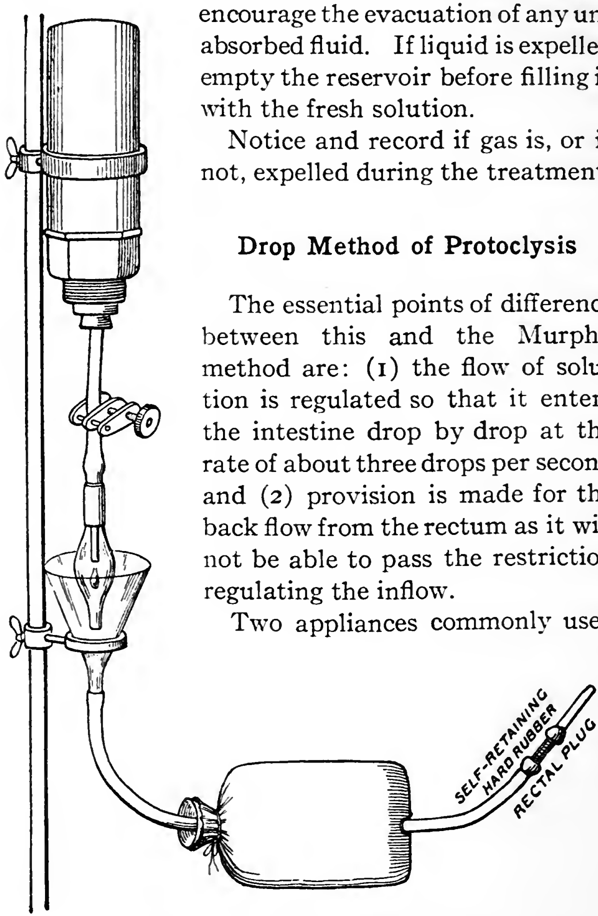

Fig. 36. Protoclysis with funnel.

for this method are shown in Figs. 34 and 35. When a dropper is used, as shown in these illustrations, it is

not essential to have a glass reservoir, for the rate of flow is judged by the drops, and a very good substitute is a thermos bottle that is provided with a one-hole rubber stopper in which a glass connecting tube is inserted for attachment to the rubber tubing. The bottle is suspended upside down as shown in Fig. 35. When the apparatus is arranged as in Fig. 35, a very essential point is to place the dropper directly above the stem of the funnel.

After letting solution run through the tubing, to warm it and expel the air, regulate the drops to the required rate (usually three drops per second) before putting the nozzle in the rectum. Otherwise, the technique is practically the same as that of the Murphy method.

Demonstration 73

Enteroclysis or Intestinal Irrigation

The treatment consists in injecting fluid into the colon in a steady stream, under low pressure, and providing for the immediate return of all that is not absorbed.

Uses: In addition to providing the body with fluids for the purposes mentioned in the first part of this section, enteroclysis is given in intestinal disturbances for various purposes; *e. g.*, (a) to cleanse the bowel of inflammatory products—as mucus—(b) to remove the products of intestinal putrefaction or irritating substances; (c) to destroy microörganisms, *e. g.*, the ameba causing amebic dysentery; (d) to destroy and remove worms.

The nature, temperature, and amount of solution used vary according to the object of the treatment. If this is to supply the body with fluid or to cleanse the bowel,[1] either half strength normal salt solution or sodium bicarbonate solution, 5%, are commonly used; when the object is to destroy microörganisms, a disinfectant is employed and, as a rule, to destroy worms, an anthelmintic. When absorption or disinfection is the object of the treatment, the temperature of the solution is usually between 100° and 110° F., but, when there is inflammation, a temperature of 116° F. or even 120° F. may be prescribed, for heat is often of value in this condition. When the fluid is to be absorbed, the treatment is generally continued for hours at a time; for the other purposes mentioned common prescriptions are to continue it until the solution returns clear or until four to six quarts of solution have been given.

Data to note and record: If the treatment is given to provide the system with fluid, measure the amount of liquid used and the quantity expelled, the difference will, of course, show the amount that has been absorbed. Record this on the patient's chart. When the treatment is used in inflammatory conditions to cleanse the mucosa, record the amount of solution given before it returned clear. Especially when the treatment is used in peritonitis, or when there is any tendency to intestinal paralysis or obstruction, note and record if gas is passed or not. This can be told by the appearance or absence of gas-bubbles in the glass connecting tube.

[1] Enteroclysis, except the irrigation described under method 3, is not used, like an enema, for cathartic purposes; in fact, if necessary, an enema is given before the enteroclysis is started.

There are several methods of giving enteroclysis. Three of those in most common use are as follows:

Method 1

Requisites: 1. A bath blanket.

2. A Kelly pad or rubber.

3. A draw sheet.

4. An irrigation stand.

5. A reservoir containing the solution with rubber tubing (about three feet) attached and a stop-cock on the tubing.

6. Two glass connecting tubes.

7. A piece of rubber tubing about two feet long.

8. A pail to catch the return flow and a stand or piece of rubber to place it upon.

9. A lubricant.

10. A double-channel colon-tube, one kind is shown in Fig. 36. A similar one can be improvised as follows: Take a soft rubber catheter (French) No. 20 (this is for the inflow) and a No. 36 (French) rectal tube (for the outflow). Make an extra hole in this, if, as is usually the case, it has but two, so that there will be a hole in the top and one on each side of the tube, about an inch from the tip. To make the hole, cut it with scissors and then smooth the edges with a piece of hot metal such as a cautery or knitting needle.

Put a piece of narrow adhesive plaster around, or otherwise mark, the catheter three inches from the tip and the rectal tube seven inches from the tip.

To connect the apparatus: Put a glass connecting tube into the free end of the tubing that is connected with the irrigator and one into an end of the other

piece of tubing, connect the former with the catheter and the latter with the rectal tube. See that the tubing for the outflow, that connected with the rectal tube, is just long enough to fall about one foot below the level of the patient. The length of the tube is of great importance; for, if it is longer than the length

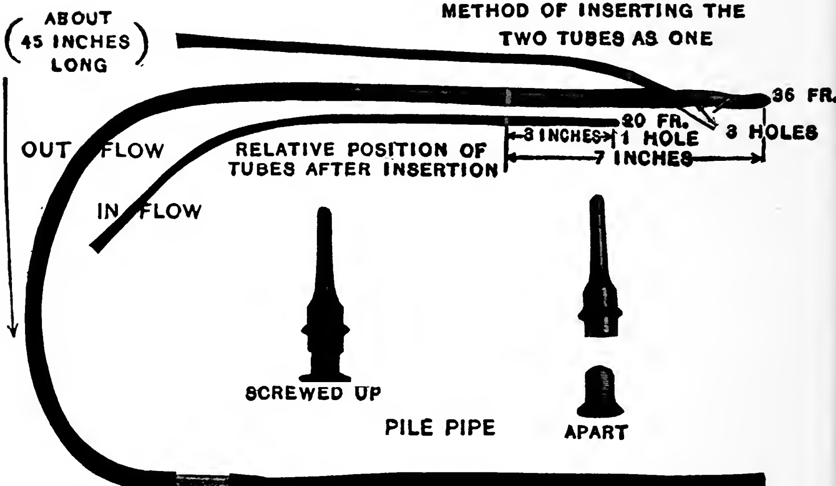

Fig. 36. Apparatus for two-tube rectal irrigation.

stated, too great suction will be promoted and the intestinal mucosa will then be drawn against the holes of the tubing and this will interfere with the smooth flow of the current. Adjust the height of the reservoir. This, when a catheter is used for the inflow and a larger tube for the outflow, is about three feet above the patient at the start, but, if discomfort is occasioned and the fluid is returning freely through the outflow tube, the indication is that the fluid is entering the intestine under too great pressure and accumulating and the reservoir should be lowered.

(Accumulation of fluid in the intestine is to be avoided for it will cause discomfort and promote muscular contractions which will cause the expulsion of the fluid and, if the patient has peritonitis, may be very harmful.) Put the catheter in the lowest hole of the rectal tube for about an inch.

Procedure: After the apparatus has been put together as just described put the thermometer in the solution and see that the temperature is right. Turn down the bed covers, and at the same time cover the patient with a folded bath blanket, to the level of the rectum.

Draw the patient, if possible, somewhat to the side of the bed.

Cover the Kelly pad, or a rubber, where it will come in contact with the patient, with a folded draw sheet and put it under her. If possible place the patient in the lateral position,[1] but the treatment can be given with the patient on her left side or in the recumbent Fowler's position.[1]

Place the pail on the stand at the side of the bed and arrange the drain of the Kelly pad, or if a rubber is used its free end, in the pail.

Let some of the solution run through the tubes to warm them and to expel the air.

Lubricate the rectal tube and catheter as far as the marks. Insert them in the rectum as far as the mark on the inflow catheter; then, holding the catheter, gently push the outflow tube farther into the rectum, until the marking is reached. This removes the catheter from the tube, but inserting them in this

[1] The descriptions of these positions were given in Demonstration 15.

way causes the patient less annoyance than when they are inserted separately.

Wait a minute, after inserting the tubes, then open the stop-cock gradually and start the flow. The solution should begin to run back almost immediately, if it does not do so, shut off the inflow and see what is wrong, for, as already stated, it is most important that fluid should not collect in the intestine. If there is any impaction of feces, it should be reported, an enema will probably be ordered.

If the treatment is given properly there will, after the first few minutes, be no discomfort. Remain with the patient until you are sure that everything is right. When the flow is properly started and the patient comfortable, draw up the bed covers and, at the same time, remove the bath blanket.

Especially during the first part of the treatment, inspect the glass connecting tube at intervals to see if there are air bubbles in it, in order to know if flatus is being expelled.

At the conclusion of the treatment, remove the tubes from the rectum (make pressure on them while doing so to avoid having solution drip on the bed or floor) and then wash, dry, and powder the patient's back.

Method 2

Equipment: The same as for Method 1 with the exception of substituting two small rectal tubes of equal caliber for the tube and catheter.

Procedure: With the following exceptions proceed as for Method 1. 1. Mark the tube for the inflow—*i. e.*, that connected to the tubing attached to the reservoir

—six inches[1] from the tip (this can be done with a thin strip of adhesive plaster) and that for the outflow five inches[1] from the tip.

2. After lubricating both tubes, insert that for the inflow one inch in the rectum and then pressing both tubes together push them gently forward until the adhesive marks are reached. The inflow tube will then be six and the outflow five inches in the rectum.

3. The usual height for the reservoir is between twelve and eighteen inches above the patient's rectum.

Method 3

This method, for obvious reasons is rarely used when treatment is given to supply the body with fluid, except when the equipment for the other method is not to be had, but it is quite frequently employed when the purpose is to ameliorate local pathological conditions, as inflammation, and is often used instead of an enema when, for any reason, it is undesirable to cause much distention of the intestine.

Equipment: 1. A funnel (one with a capacity of 1½ pints is to be preferred and the lumen of the stem should be half an inch in diameter).

2. Tubing, about one third of an inch in diameter and two feet in length, attach this to the funnel.

3. A glass connecting tube; put one end of this in the tubing.

4. A medium-sized rectal tube with two holes, mark it six inches from the tip, insert the free end of the connecting tube in it.

[1] For a child, mark one tube three and the other four inches from the tip.

5. A lubricant.
6. A Kelly pad or rubber.
7. A dressing towel.
8. A pail and a rubber to stand it upon so as to protect the floor.
9. A bath blanket.
10. A thermometer.
11. Pitchers of solution. The number depending upon the amount of solution required. It is better to have several pitchers of a size that can be easily held (*i. e.*, that will hold about two quarts) rather than a very large one. The temperature of the solution that will be used last should be from 5° to 6° higher than that used at the beginning of the treatment, both to allow for cooling and because the patient will then be able to stand a higher temperature.
12. A washcloth.
13. Talcum powder.
14. If the treatment is used instead of an enema, a bedpan. This may not be required, for feces will pass from the rectum, through the funnel, with the return flow, but, if there is much fecal matter in the lower part of the intestine, it is sometimes necessary to suspend the treatment after some of the liquid has been injected, until the patient has had a movement of the bowels.

Procedure: In the same manner as for Methods 1 and 2, substitute the folded bath blanket for the covers over the upper part of the body; place the patient in position and arrange the Kelly pad, or rubber, and pail. Have the dressing towel on the pad or rubber where it will come in contact with the patient.

Lubricate the seven inches of the tube that are to be inserted.

Take the funnel in the left hand, fill it with solution and let some of the latter run through the tubing to warm it and expel the air, but do not let the funnel become empty. (A good way to hold the funnel, while doing this and during the treatment is, as shown in Fig. 23, with the little finger in front of the tubing, just at the bottom of the funnel stem, because by moving the finger backward, the wall of the tubing becomes pressed against the stem and the flow is thus easily checked, while a forward movement of the finger at once allows the current to continue.)

Check the flow.

Insert the rectal tube about six inches or, for a child, about four inches.

When the tube is in place, wait a moment for the patient to become accustomed to its presence and then, holding the funnel between twelve and eighteen inches above the patient, fill it and allow about one pint of solution to flow slowly into the intestine (do not allow the funnel to become empty for this will interfere with siphonage) then, quickly lower, and invert the funnel over the pail.

When the solution ceases to flow back, compress the tubing against the funnel stem, so that air will not enter the former, then turn up the funnel and fill it as quickly as possible; release the check and proceed as before. Continue the process until the required amount of solution has been used.

At the completion of the treatment, care for the patient as after Method 1 and do not forget to make pressure upon the tube while removing it.

Demonstration 74

Hypodermoclysis

Hypodermoclysis, or infusion into the subcutaneous tissues, is used chiefly as a substitute for protoclysis when, for any reason, it is not advisable to inject fluid into the rectum.

Equipment: 1. A reservoir for the solution, unless, as is done in some hospitals, the solution is siphoned from the flask in which it is sterilized, in which case a syringe to start siphonage[1] and a U-shaped piece of metal rounded like a piece of tubing cut in half lengthwise, and known as a *tube-carrier*, will be needed to keep the tubing from being bent on the rim of the flask. See Fig. 37.

2. A piece of one quarter of an inch diameter tubing about four feet in length and a piece or, if two needles are used, two pieces of tubing about twelve inches long.

3. A glass connecting tube, this, if two needles are used must be either T- or Y-shaped. The object in using a connecting tube when only one needle is employed is that air bubbles will be seen in it should the solution get too low in the irrigator.

[1] This is done by, after putting one end of the long rubber tubing in the solution and fixing it in position with the tube carrier (its end must be almost in contact with the bottom of the flask), inserting the point of the syringe in the other end and drawing out the piston until liquid appears in the syringe. The latter is then withdrawn and the connecting tube to which the other piece or pieces of tubing with the needle attached are inserted and the liquid allowed to run through. Pressure is then made on the tubing to stop the flow until the needles are inserted.

4. One or two needles.
5. A thermometer.
6. Two sterile towels in addition to those used to cover the tray.
7. Eight sterile sponges.
8. Four sterile swabs for applying the iodine and collodion.
9. A hypodermic syringe containing local anesthetic, either cocaine 2% or novocaine are generally used.
10. Two flasks of normal salt solution. One of these should be about five degrees hotter than the temperature required (this is usually 110° F.) to allow for cooling, and the other about ten degrees hotter (*i. e.*, it should be 120° F.).

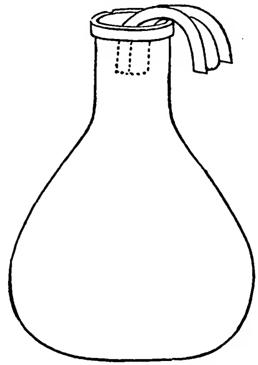

Fig. 37. Curved tube-carrier over rim of flask.

11. The detergent and disinfectant for the skin. Ether and diluted iodine solution (3%) are commonly used for this treatment.
12. Ethereal collodion.
13. Adhesive plaster.
14. A kidney basin.
15. A bag for used sponges and swabs.
16. An irrigator stand.

Articles 1 to 10 inclusive are to be sterile.

Procedure: Arrange the equipment: Place the irrigator stand on one side of the bed.

Scrub two trays or tables and dry them with a sterile towel.

Place articles 1 to 8 inclusive on one of these and 9 to 15 on another.

If articles 1 to 7 are kept sterile ready for use, as is a common practice, remove the band keeping the bundle closed and the outer wrapper, but do not open the bundle until you have cleansed your hands. If these things are not kept sterile, sterilize them according to the directions given on page 14, and, before touching them scrub and disinfect your hands, cover the tray or table with a sterile towel, put the disinfected articles on this and cover them with a sterile towel.

Feel the patient's pulse so that you will be able to tell if it is improved by the treatment.

Arrange the patient in a comfortable position and adjust the nightgown.

Cleanse and disinfect your hands.

Cleanse and disinfect the patient's skin at the point or points selected for the puncture. This, in women is usually the loose tissue at the base of the breasts and in men in the loose tissue of the flanks, in that just below the axilla, or at the base of the scapulæ.

Scrub your hands with the disinfectant.

Open the bundle of sterile articles, do not touch the outside of the bundle.

Place the sterile towels so that they surround the area of injection.

Connect the apparatus (*do not touch the needles except at their sockets*) and prepare the solution, leave the thermometer in the latter. (Observe the thermometer from time to time during the treatment and, if necessary, add hot solution. When you do so remember the amount added.)

Expel air from and warm the tube by letting solution run through.

A doctor usually injects the anesthetic and inserts

the needles, but the treatment is sometimes given by senior and graduate nurses for, though it is very important to carry out the technique most carefully, to do so does not require knowledge that cannot be gained by frequently seeing the treatment given.

The precautions required are: Asepsis, the proper insertion of the needles (this must be seen to be understood), and the regulation of the infusion to keep pace with the rate of absorption. This is exceedingly important, for, if the fluid accumulates, its pressure upon nerve endings will cause pain and, by compressing blood-vessels, it may so interfere with the circulation in the part that a slough will follow. Thus, the tissue should not be allowed to become distended and, to help avoid this, massage the site of injection and surrounding area making pressure away from the points where the solution is entering. The object of using two needles is to obviate the necessity of introducing a large amount of solution in one place.

As a rule from one to two pints of liquid are given at a time.

When the required amount has been injected, withdraw the needles. Place a sterile sponge over each puncture and gently massage the surrounding parts until fluid ceases to ooze from the holes. Then, seal these with collodion and, when this has dried, cover the punctures with sterile sponges and strap these in place with narrow strips of adhesive plaster.

Demonstration 75

Intravenous Infusion

By intravenous infusion is meant the introduction of fluid into a vein. This method of infusion is used

chiefly when, as in shock and hemorrhage, an immediate result is required. The chief effects sought at such times are: (1) a rise of blood pressure and, to further this, either adrenaline or pituitrin[1] is added to the solution; (2) to prevent injury to the tissue cells from loss of fluid; and (3) following hemorrhage to keep the remaining red corpuscles in circulation so that a fatal loss of oxygen[2] will be prevented until new corpuscles are formed.[3]

The solutions most commonly used for intravenous infusion are: Normal saline,[4] Lock's solution,[5] Ringer-Lock solution,[6] Dawson's solution.[7] Also, some drugs, as salvarsan, and certain sera are given intravenously.

Three requirements for substances injected into a vein are: (1) They must be sterile; (2) they must be isotonic[8] with the blood as, otherwise, they will cause hemolysis,[8] and free from any substance that will do this for any other reason; (3) they must not, unless conditions call for interference, affect the coaguable[9] property of the blood.

[1] Why will these drugs further a rise of blood pressure? Why is pituitrin used instead of adrenaline when there is any tendency to edema of the lungs? If unable to answer these question see under adrenaline in textbook of Materia Medica.

[2] Why will loss of red corpuscles entail loss of oxygen?

[3] When and where are red corpuscles formed? If unable to answer see textbook of Physiology.

[4] 0.9% sodium chlorid solution.

[5] Sodium chlorid 0.9 gm.; potassium chlorid, 0.042 gm.; calcium chlorid, 0.0024 gm.; sodium bicarbonate, 0.03 gm.; dextrose 0.1 gm.; and sufficient distilled water to make 100 c.c.

[6] The same as Lock's solution minus the dextrose.

[7] 0.8% of sodium chlorid and 0.5% of sodium bicarbonate.

[8] If not understood, see Glossary.

[9] Describe the process that is supposed to occur when blood clots. If unable to do so see textbook of Physiology.

Many substances, including air, will, if admitted into a vein, cause destruction of blood platelets and so initiate the formation of a thrombus, which, under the influence of the treatment will almost surely be followed by embolism.[1]

Equipment: 1. A reservoir or, if the liquid is siphoned from the flask, the substitutes mentioned in the equipment for hypodermoclysis.

2. A piece of tubing about three feet in length, which is attached to the reservoir, and a piece about twelve inches long. There should be a stop-cock on the long piece.

3. A straight glass connecting tube, which is used to unite the two pieces of rubber tubing. This is employed in order that should air enter the tubing, air bubbles may be seen, in time to shut off the current and so prevent the air entering the vein.

4. A canula and an infusion needle.

5. A *sharp* scalpel.

6. A pair of *sharp* scissors.

7. Two hemostats.

8. A pair of dissecting forceps.

9. A thermometer.

10. An aneurysm needle, threaded with heavy silk.

11. Two surgeon's needles threaded with suture silk.

12. Twelve gauze sponges.

13. A small sterile dressing.

14. A gauze bandage.

15. Five sterile towels other than those used to cover the tray and apparatus.

16. A tourniquet. A piece of rubber tubing or muslin bandage can be substituted.

[1] What may be the result of embolism? Why?

17. A hypodermic syringe containing the local anesthetic. Cocaine or novocaine, with or without adrenaline, is commonly used.

18. A sterile basin containing hot (120° F.) normal salt solution.

19. Two sterile aprons and two pairs of sterile gloves. These are left in their wrappings until needed.

20. Catgut in a covered jar.

21. Suture silk in a covered jar or tube.

22. Three flasks of solution. One of these should be a few degrees hotter than the required temperature (which is usually between 116° and 120° F.) to allow for cooling, one should be considerably hotter as it will only be used if necessary to raise the temperature of the former, and one cold.

23. The preparation tray and, unless iodine is used, a dressing basin containing hot water, a sterile compress and necessary disinfectant. (If iodine is used as a disinfectant either ether or acetone is generally used for cleansing the skin, but, as the color of iodine makes it somewhat difficult to discern the vein, other disinfectants are sometimes substituted for this treatment and then the skin is scrubbed first with green soap or lysol and hot water and then with either ether or alcohol or both, and covered with a sterile compress wet with disinfectant. If iodine is used, it is washed off, usually with alcohol, when the doctor is ready.

24. A dressing rubber.

25. A kidney basin.

26. A bag for soiled sponges.

27. A small basswood splint.

28. An irrigator stand.

29. Two trays.

30. A drop light, except when the light is very good.

31. Disinfectant for the hands.

Articles 1 to 23 inclusive are to be sterile.

This treatment is always given by the doctor, but, in order to give efficient assistance, it is necessary for nurses to know something of the nature, therefore the following brief description is given before the details, of the work expected of the nurses.

Usually, either the median cephalic or the median basilic veins on the anterior surface of the elbow is chosen for the reception of the fluid and in order to distend them a tourniquet is put around the upper arm tightly enough to interfere with the venous current. A local anesthetic is injected under the skin of the area except when the patient is unconscious. An incision is made over the chosen vein and two ligatures are slipped under it with an aneurysm needle, one below and the other above the point where a small incision is to be made in the upper wall of the vein. The lower ligature is tied, the incision made and after air has been expelled from the tubing and canula, the latter is slipped into the aperture. The other ligature is then tied around the canula and vein. As soon as the solution flows into the vein, the tourniquet is slowly loosened. The wound is kept moist during the operation with hot saline solution in order to prevent blood clotting. When the required amount of solution has been given the canula is withdrawn, the wound sutured, a dressing applied and, sometimes, especially if the patient is delirious, a short basswood splint is put over the dressing to keep the arm straight.

Sometimes, the infusion needle is used instead of a

canula and, in such case, no incision is made, the needle being stabbed through the skin into the vein pointing towards the heart.

Nurses' duties: There should, if possible, be two nurses to prepare for this treatment and to help the operator, one of whom should act as assistant to the other and do the preliminary stages of the preparation of the patient and the handling of unsterile articles after the other nurse has disinfected her hands and put on sterile gloves and apron.

A good method of procedure is about as follows: The assistant collects the articles required for preparing the patient, except the sterile towels (*i. e.*, articles 23 and 24); removes the patient's arm from the nightgown; puts the rubber under it; cleanses and disinfects her own hands thoroughly, as described, page 288, and then proceeds with the preparation (see page 290). The sides and anterior surface of the arm at and for about three inches above and below the elbow are to be prepared. If the sterile nurse is not ready to complete the treatment, *i. e.*, to apply the disinfectant and arrange the towels, the assistant can scrub her hands with the disinfectant and finish this work, being careful not to let her fingers come in contact with the patient's skin that is being prepared or anything that will touch this or the surface of the towels that will be uppermost during the operation. Put a sterile towel under the patient's arm, one around the forearm and hand, leaving it rather loose around the latter so that a nurse can slip her hand under it as required, and a third around the upper part of the arm. This, if the tourniquet is sterile, should be smooth and adjusted securely, otherwise, it should be rather loose, as

the tourniquet must, if unsterile, be applied underneath it.

At the same time, let the other nurse put the flasks of solution to heat; place the irrigation stand, and, if necessary, the light by the bedside; collect the rest of the apparatus; wash the trays with lysol or green soap solution and warm water and dry them with a sterile towel. Arrange articles 1 to 18 inclusive, on one tray and the others, not already disposed of on another, for, while the contents of the jars, etc., mentioned after 19 are sterile the outside of the containers are not and thus should not be placed where they may come in contact with instruments and dressings.

As this treatment is used so frequently in emergency it is an almost universal custom in hospitals to have articles 1 to 16 inclusive kept sterile, ready for use, rolled in sterile towels. If this is not done, sterilize them as already directed and cover the tray on which they are to be placed with a sterile towel. The innermost towel surrounding the appliances serves for this purpose when they are kept ready for use.

In such case, when everything has been collected remove the outer wrapping of the bundle, but do not open the latter until you have prepared your hands and put on the apron and gloves.

When you have done so, connect the pieces of the tubing to each other and to the irrigator as described, page 397; hang the latter about two feet above the patient; arrange the instruments in the order in which they will be used. Put the sterile towels on one side (three of these will be needed for the patient; one to cover the irrigator and one for handling articles

that may not be absolutely sterile, as the exterior of the flasks containing the solution). Prepare the solution and leave the thermometer in it. Put a sterile towel over the top of the irrigator. Insert the canula (or needle if required) in the tubing, *being very careful to touch it only at the socket.* Let the solution run through until all air is expelled. If air, as already stated, gets into the vein it may cause the formation of a thrombus. Keep a sterile towel over the apparatus until the doctor is ready.

When the operator is ready, apply the tourniquet around the upper part of the arm while the unsterile nurse, putting her hand under the towel, keeps track of the patient's pulse. The tourniquet is to be applied with sufficient pressure to distend the veins in the elbow joint but not tightly enough to stop pulsation in the radial artery. Should the tourniquet not be sterile, take off your gloves while you adjust it and put it under the towel covering the part and, when the time comes for it to be loosened, as you will have resumed your gloves, the *unsterile nurse* will have to attend to it (it will not then be necessary to observe the pulse as when applying it), and while she is doing so you (the *sterile nurse*) hold the patient's hand, over the sterile towel, to prevent her moving her arm.

During the operation the *sterile nurse* is responsible for the temperature of the solution and is ready to assist the doctor while the assistant, keeping her hand under the towel, over the patient's wrist, restrains the latter's hand and watches her pulse. Also this nurse, as a rule, is responsible for watching the amount of solution used (she stands facing the irrigator) and notifying the doctor when the required amount has been given and before the latter gets low enough in

the irrigator to allow the entrance of air into the tubing.

As a rule, in the treatment of shock not associated with hemorrhage, about 500 c.c. are used and, after hemorrhage, about 1000 c.c.

The patient is very likely to have a chill about twenty or thirty minutes after an intravenous infusion, especially when normal saline solution is used. The cause of this is not definitely known. Usually, the chill soon ceases and is not followed by a rise of temperature or other untoward effects, but the patient should not be left alone while it lasts and, if conscious, must be reassured. Keep hot-water bags in the bed until the chill ceases.

Transfusion

The term *transfusion* is, in therapeutics, applied to the transfer of blood from one person (*the doner*) to another (*the donnee* or *recipient*).

At one time it was thought that the blood of some of the lower animals could be used for this purpose, but it was found that the blood of one species of animal is hemolytic[1] to that of another species. In fact, the blood of one person may be hemolytic to that of another, even a near relative. Therefore, except in extreme emergency, a small amount of blood is taken previous to the operation from both doner and expectant recipient and the action of the bloods upon each other is tested. The doner's blood is examined also for bacteria.

Important advantages that transfusion has over

[1] What is meant by hemolysis? What may be the results of hemolysis?

saline infusions are: Blood does not transude through the blood-vessels into the tissues as quickly as the saline solutions do and thus will maintain blood pressure for a very much longer time; the blood supplies oxyhemoglobin and thus, after hemorrhage, the body will be at once supplied with its necessary oxygen; and the transfusion may increase the coagulability of the recipient's blood and thus inhibit further hemorrhage; blood supplies leucocytes and other antibacterial substances and possibly antitoxins which may be of use.

The disadvantages of transfusion have been largely overcome by increased laboratory facilities and improved technique. The disadvantages were the danger of: (a) introducing blood clots into the circulation; (b) causing intravascular clotting[1]; (c) producing hemolysis; (d) transferring disease.

There are a number of methods of transfusion used. In what is known as the *direct method* one of the doner's arteries and of the recipient's veins are incised and the two so connected that the blood flows from the former into the latter. A sphygmomanometer is applied around the doner's arm so that the fall of blood pressure induced by the loss of blood can be observed and the flow checked before this becomes serious. This (the direct) method is not now, except in emergency, as much used as the indirect methods, these, especially the *Lewisohn* or *sodium citrate method*, having several advantages. When devising indirect methods, an indispensable consid-

[1] Describe the process that is thought to occur when blood clots? State conditions that help and retard those blood clotting. If unable to do so read section on coagulation of blood in textbook of Physiology.

eration was to provide means to prevent the blood clotting for, as soon as blood comes in contact with the air, rough surfaces, and the majority of foreign substances, blood platelets are disintegrated and an activating substance of the coagulation process that they contain is liberated. There are a few substances, however, which will, if mixed with blood, cause chemical changes in some of its constituents that will prevent clotting, but will not affect the physiological value of the blood. This is true of sodium citrate.

In the sodium citrate method, which is the system of transfusion in most common use at the present time, blood is withdrawn through a needle from a vein at the doner's elbow into a flask containing sodium citrate solution. After sufficient blood has been obtained, it is strained through sterile gauze into a special (sterile) flask from which it can be withdrawn into the syringe which is used to inject it into the recipient's vein.

The whole operation is performed by doctors and the nurse's duties usually consist in preparing the doner's arm and, later, the donee's, and sterilizing the apparatus. Also, the nurse must keep careful watch of the patient after the treatment and report any adverse symptoms should such occur, because very serious reactions sometimes follow transfusion. Common symptoms of these are: Flushing of the face, urticaria, headache, muscular pains, nausea, vomiting, chill followed by a rise of temperature. The reason for reactions is not positively known, but it is thought probable that they occur as the result of some incompatible quality in the doner's and the recipient's blood.

CHAPTER XIII

Medication

Different ways of giving medicine. Prescription book. Abbreviations and symbols used in writing prescriptions. Special points to remember regarding the care necessary in the administration of medicines. Two common systems of regulating the administration of medicines. Methods of giving medicine by mouth. Inhalations. Application of medicine to the throat and eye.

Medicinal substances are used to cause both local and general or systemic effects. For local effects they must be so applied that they will come in contact with the part that they are to act upon; for systemic effects they must be either absorbed by the blood or act upon nerve endings and thus obtain results through the nervous system as described under counterirritation in Chapter XIV.

Drugs may be given: by mouth; through the lungs; by rectum; as subcutaneous, intramuscular and intravenous injections; and they may be applied externally.

The Prescription Book

In order to prevent mistakes in receiving and carrying out physicians' orders and to protect nurses from unjust accusations, it is a common custom in hospitals for each ward or floor to be provided with

a *prescription book* and the nurses, except in emergency, are not allowed to give medicines or treatments until the order is written in the book by the physician or, if he authorizes a nurse to write it, signed by him. If the order is necessarily given by telephone or, for any other reason, it is impossible for the doctor to write or sign it, the nurse receiving the order is required to write it in the book and sign her name.

Abbreviations and chemical symbols very commonly used in writing prescriptions are as follows:

Abbreviation	*Derivation*	*Meaning*
aa	ana	of each
A. c.	ante cibum	before meals
Ad lib.	ad libitum	as much as desired
Alt. dieb.	alterius diebus	every other day
Alt. hor.	alterius horis	every other hour
Alt. noc.	alterius nocta	every other night
Aq. dest.	aqua destillata	distilled water
Aq. pur.	aqua pura	pure water
B. i. d.	bis in die	twice a day
C.	congius	a gallon
C.	. . . . . .	centigrade
Cum.	cum	with
Cc. or c. c.	. . . . . .	cubic centimeter
Cap.	capiat	let him take
Dil.	dilutus	dilute
F.	. . . . . .	Fahrenheit
F.	fac	make
Fld.	fluidus	fluid
Ft.	fiat	let it be made
Gm.	. . . . . .	gram, grams
Gr.	granum, grana	grain, grains
HCl	chemical symbol	hydrochloric acid
KI	chemical symbol	potassium iodid
Lb.	libra	pound
Liq.	liquor	liquid
M.	misce, mistura	mix, mixture
M.	minimum	a minim

Abbreviation	*Derivation*	*Meaning*
Mil.	.. .. ..	milliliter
NaCl	chemical symb l for sodium chlorid	salt
O.	octarius	a pint
P. c.	post cibum	after meals
P. r. n.	pro re nata	as occasion arises
Pulv.	pulvis	powder
Q. h.	quaque hora	every hour
Q. s.	quantum sufficit	as much as is sufficient
℞	recipe	take
S. or sig.	signa	give the following directions
S. o. s.	si optus sit	if necessary
Ss.	semi, semissis	one half
Tinct, or tr.	tinctura	tincture
Ung.	unguentum	ointment
μ	micron	the millionth part of a meter
ʒ	drachma	dram
℥	uncia	ounce

Points of special importance to remember regarding the care, measuring, and administration of medicines are:

1. Keep medicine cupboards locked and do not leave the key where patients can get it.

2. To expediate giving medicines it is well to keep them, as far as possible, in alphabetical order, but with those intended for external use and the stronger poisons separate from others and, especially the latter, in bottles with a rough exterior. or other easily discernible characteristic, and marked "For External Use" or "Poison."

3. Never have medicines in unmarked bottles and do not use a dose of medicine that has been left in an unmarked glass.

4. Never order a large amount of a medicine at

a time; there are few drugs that do not deteriorate with age and, for the same reason, do not use a drug that has anything unusual in its appearance.

5. Keep oils in a cool place. Also many of the antitoxins, vaccines, and drugs derived from animal glands need to be kept cold.

6. Give medicines on time.

7. While measuring medicines, never think of anything but the work on hand and never speak to anyone nor allow anyone to speak to you.

8. Use graduated glasses and pipettes, not spoons, for measuring.

9. Measure minims, when minims are ordered, and drops when drops are ordered, for, in some drugs, there is a marked difference between the amount in minims and drops.

10. Measure exactly; never give a patient a drop more or less than the amount ordered.

11. While pouring a medicine, hold the glass with the mark of the quantity you require on a level with your eye; if the mark is above your eye, you will give too little, if below, too much.

12. Read the label on the bottle thrice, before taking it from the shelf, and before and after pouring out the drug.

13. Shake the bottle before pouring out medicines that are not perfectly clear or that have a sediment.

14. To avoid defacing the label while pouring a medicine, hold the bottle so that the label will be on the upper side, but do not let your hand come in contact with it, and before replacing the bottle on the shelf, wipe the rim of the bottle with a piece of gauze.

15. Always recork bottle immediately after pour-

ing out the drug, for many medicines contain volatile substances and will thus become either stronger or weaker if left uncorked.

16. Never mix nor give at the same time, without speaking to the doctor, medicines which change color or form a precipitate when combined, for, when they do, a chemical change has probably taken place.

17. Some foods must not be given near the time for doses of certain drugs, *e. g.*, milk and eggs near a dose of calomel, the protein of which would combine with the mercury to form an albuminate of mercury. Drugs and foods which should not be given at the same time are mentioned in textbooks of Materia Medica and this is one of the important items for nurses to remember in this study.

18. Remember, and put into effect, all information given in Materia Medica regarding the dilution of drugs; three points of special importance are, (1) do not dilute syrup cough medicines, because dilution will minimize the soothing effect of the syrup on the mucous membrane; (2) drugs that will irritate the mucous membrane of the alimentary tract to an injurious degree are to be given well diluted; (3) saline cathartics that are given to lessen edema are to be given in a concentrated solution, for this favors the removal of fluid from the tissues, but when given for cathartic purposes only they are usually given well diluted as they then act more quickly; for reasons see Materia Medica.

19. Make doses of medicine as palatable as possible. Therefore, have the water used for dilution either very cold or very hot. When possible, give unpleasant tasting drugs, especially powders, in capsules or konseals, and have ice water or other

drink at hand in a *clean glass* to give as soon as the medicine is taken. A good method of giving castor oil is to rinse the entire inside of the glass with lemon juice, and leave about one or two drams in it, put in a small piece of ice (about the size of a pea), pour in the oil and on top of this some more lemon juice or a dram of whiskey, or peppermint water and just before giving the patient the dose, add a little vichy water to it. Have a clean glass with vichy to give the patient afterward. *Oleum tiglii* (croton oil) can be given in a capsule if the patient is conscious, otherwise it is usually best given on sugar or in melted butter, and dropped on the back of the tongue.

20. Give acids and medicines containing iron through a tube, because acids may corrode the teeth and iron discolors them.

21. When giving medicine by mouth to an unconscious patient drop it far back on the tongue using a spoon, not a glass, and give it slowly.

22. Never allow one patient to carry medicine to another; innumerable mistakes have been thus made.

Demonstration 76

Measuring Medicines for Administration by Mouth

Requisites: 1. A tray holding medicine glasses.
2. A pitcher of ice water.
3. A gauze compress.
4. Bottles similar to those used for poisonous and non-poisonous drugs.
5. Cards or medicine list as required by the system in use in the hospitals in which the pupils

are studying. The requirements for two systems that are in very common use are as follows:

System 1. Pieces of thin colored cardboard, about two inches square, a different color for each period of administration; *e. g.*, red may be used to signify every four hours; pink, every three hours; blue, before meals; yellow, after meals; white, at night; gray, in the morning. The tickets are inscribed with the patient's name, the name and dose of the medicine, and the hour at which it is to be given. Tickets of each color are kept in a separate bundle.[1]

System 2. This requires a medicine tray marked in numbered squares, the numbers corresponding to those of the room or, in a ward, the beds, and a medicine list. A convenient form of list is shown in Fig. 38.

Procedure for System 1: Spread out the tickets of the color for the hour of administration in a row or rows, putting all those calling for the same drug together.

Take a medicine glass in the left hand and, after reading the label, the bottle of medicine in the right. Hold these as directed in sections 11 and 14.

Shake the bottle if necessary.

Read the label.

Take the cork between the third and fourth fingers and extract it. Hold it thus while you are pouring out the drug.

Raise the glass until the mark representing the amount of drug that is to be given is on a level with your eyes.

[1] The tickets for System 1 and for a medicine list such as is shown in Fig. 38, are made out and old ones destroyed as soon as medication is prescribed or changed, and a check is made in the prescription book to indicate that this has been done.

MEDICINE LIST

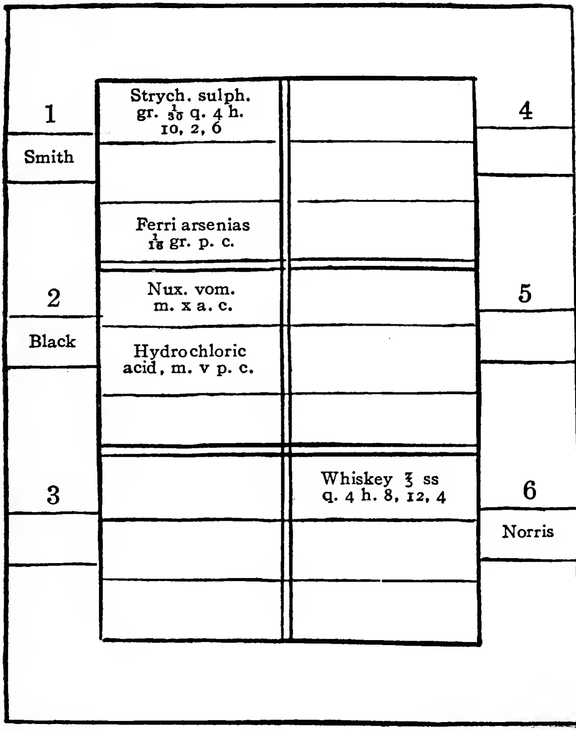

Fig. 38.

The holder for the medicine list consists of a flat piece of metal painted with white enamel, of sufficient size to be divided into as many spaces about 2 in. sq. as there are beds in the ward. The holder is surrounded with a frame. This frame is only attached to the foundation at the points of the metal strips which divide the squares, in order to leave a space between the two to allow of the insertion of the cards bearing the name of the medicine, etc. The squares are subdivided by narrow strips of grooved metal so that a separate space can be allotted to the several times when the medicines are to be given and differently colored cards should be used for the various times of administration. The frame is provided with grooved strips to hold the patients' names and the numbers are painted on it in black or other dark color paint

Pour in the drug until it is on a line with this mark.

If more than one patient is getting the same medicine, pour out the number of doses required; if not, put the cork in the bottle, wipe the rim of the latter with the gauze compress, read the label on the bottle and return it to the shelf.

Pour some ice water into the glass or glasses and cover the latter with the tickets. Note the directions on these and be sure that you have complied with them.

Proceed in the same manner until all the medicines needed have been measured.

Put some empty glasses on the tray. These may be wanted to give patients water following medication with an unpleasant flavor.

Carry the tray and its contents and a pitcher of water to the patients.

Read the patient's name on each card before giving the medicine.

Count the cards, to make sure that you have not lost any, and put them away.

Wash the medicine glasses.

Procedure for System 2: Place the medicine list where it can be easily read.

Put a medicine glass in each of the squares with the numbers for the patients who are to have medicine.

Read the list and notice how many patients are to have the same medicine so that all doses of the same drug may be poured before putting away the bottle.

Pour the medicines in the same manner as for System 1 and, when they have all been poured, add water or other diluent as required.

Before giving a patient a drug note the number of the square from which you take the glass.

Demonstration 77

Inhalations

Requisites: 1. Nitrite of amyl and a gauze compress.

2. Stramonium leaves; a bowl; stiff paper or cardboard with which to make a cone as described on page 417; pins.

3. Apparatus for oxygen inhalations, this consists of a tank of oxygen; a thick glass flask with a wide neck into which is fitted a cork with two holes and, in each hole, a curved glass tube one of which extends about an inch into, and the other almost to the bottom of, the flask; water enough in the flask to about half fill it; two pieces of rubber tubing, one of which is about thirty-six inches long (it must be long enough to reach from the flask to the patient's mouth) and the other long enough to connect the flask and tank (the length necessary will depend upon where the flask is placed, sometimes this is on a table put near the tank, but some tanks have an attachment for the flask and in such case the tubing need be only a few inches long); a funnel.

4. A Maw's inhaler and bath towel or whatever form of inhaler the hospital supplies for direct steam inhalations.

5. Apparatus for steam inhalations with a tent; this usually consists of a kettle with a long spout (commonly known as a *croup kettle*, because this treatment is frequently used for the relief of croup); a screen or other foundation for the tent; a piece (about half) of an old blanket; two sheets; pins; a stove; a stand for the latter and, if necessary, something to protect this from the heat.

Certain volatile drugs are given by inhalation either with the expectation of their being absorbed and producing systemic effects (*e. g.*, general anesthetics and amyl nitrite) or fairly localized effects (*e. g.*, stramonium) or to ameliorate abnormal conditions of the mucous membrane of the respiratory tract by direct action upon the membrane. Drugs intended chiefly for the latter purpose (*e. g.*, eucalyptus and benzoin) are usually given with steam, and steam is sometimes used alone for this purpose as it has a very soothing effect upon dry and irritated mucous membranes.

Nitrite of Amyl

Procedure when giving a nitrite of amyl inhalation: Break a pearl,[1] or else pour the amount of drug prescribed (usually five drops) from the bottle on to a gauze compress and hold this a short distance above the patient's nose and mouth. Keep it thus until the symptoms for which it is given are relieved or the drug has evaporated. Be careful while doing so not to inhale the drug yourself for it causes dilation of the arteries and, when this is not necessary, headache, dizziness, faintness, and other unpleasant effects may follow.

Stramonium and Belladonna

Stramonium and belladonna are sometimes given by inhalation to relieve asthmatic spasms, because these drugs are absorbed by the mucous membrane with which they come in contact and, by depressing

[1] Pearls are small capsules of thin glass in which, for convenience in using it, the drug is sold.

secretory and bronchial motor nerve endings, they lessen the secretion of mucus and the contraction of the bronchial muscle. When the drugs are given in this manner, leaves containing them are burned and the smoke inhaled. The leaves may be bought prepared in the form of cigarettes or loose. Stramonium and belladonna cigarettes are smoked in the same manner as those of tobacco, but the patient is to be instructed to inhale as much of the smoke as possible. If the leaves are loose, place them in a bowl; make a cone of paper or cardboard the largest end of which will fit around the bowl, set fire to the leaves; put the cone over the bowl and have the patient inhale the smoke through the free end.

Oxygen

Oxygen inhalations are used to counteract the effects of depressed breathing, to counteract the bad effects of conditions producing cyanosis, to reduce the rate of the heart and cause a rise of arterial tension. The oxygen is procured for use in this way in steel containers. For administration it is passed through water with two objects in view; (1) to gage the amount of gas being used; (2) it is thought that, possibly, the oxygen may become somewhat moistened and thus have a less drying effect upon the mucous membranes than it otherwise has.

To give an oxygen inhalation: Stand the oxygen tank near the head of the bed; fill the glass flask half full of water, insert the cork with the glass tubes as described on page 415, connect the longest of these tubes with the tubing extending from the oxygen container and the shorter one with tubing that is long enough to reach from the container to the pa-

tient's mouth, insert a funnel in the free end of this tubing. Turn the key of the container sufficiently to start the oxygen flowing through the bottle at a rate that will form *small* bubbles in the water. Do not hold the funnel over the bed until you have the flow of gas adjusted for, if too much is allowed to enter the bottle, water may be blown through the tubing. When the flow is regulated, hold the funnel near the patient's nose and mouth, not too close, or the air exhaled by the patient will strike against the funnel and be thrown back.

Steam

Steam inhalations may be given with the apparatus so arranged that the exit for the steam is in close proximity to the patient's mouth as the heat of the vapor will permit or a large kettle may be used and placed at a slight distance and a canopy or tent arranged above the bed, over the patient's head and shoulders, so as to direct the steam toward the patient in a manner that will allow of its being inspired.

The Maw's inhaler[1] is a commonly used type of inhaler for a close inhalation. To use one: Heat the utensil by pouring hot water into and over it. Pour out this water and then pour in enough boiling water to reach the lower level of the opening of the air channel (the water must not cover this); add the drug that has been prescribed; insert the cork with the mouthpiece attached; wrap a piece of heavy

[1] This is a carafe-shaped utensil, the top of which is fitted with a cork that has a hole in the center into which a mouthpiece fits and at the side of the flask there is a hollow projection through which air enters and forces the vapor upward.

flannel or a bath towel around the inhaler, leaving the mouthpiece and the air tube free.

Arrange the patient, lying or sitting, in a comfortable position and place the inhaler so that she can hold the mouthpiece in her mouth without effort. If the inhaler is properly protected and the water boiling when it is put in, it will keep hot enough for vapor to continue to ascend for fifteen or twenty minutes.

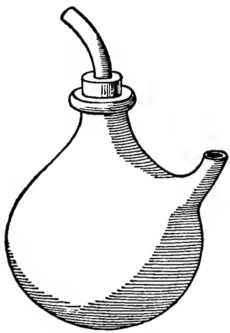

Fig. 39. Maw's inhaler.

An ordinary pitcher is sometimes used instead of a Maw's inhaler, but for obvious reasons, it is not as good.

The procedure in preparing for a steam inhalation in which a canopy is used depends upon the nature of the frame provided, but the essentials are: 1. That the roof of the canopy be lined with a piece of old blanket or other material that will absorb moisture readily, otherwise, if the room is cool, the moisture may condense and drop on the patient or bedclothes.

2. The stove is to be placed where there is no danger of the bed-covers coming in contact with it or else a guard should be put around it.

3. The spout of the kettle must not project far enough under the canopy for it to come in contact with the patient.

4. The canopy is to be neatly arranged and must not exclude the air.[1]

[1] It is a common error in arranging these canopies to surround the patient too completely in the hope of localizing all the steam possible, but, in conditions calling for such treatment, the patient needs an extra, and not a restricted, supply of air.

In Figs. 40 and 41, the canopies are made over iron frames which are attached to the upper bars of the bed by means of curved hooks.

To arrange a canopy as in Fig. 40, cover the frame with a piece of blanket and this with a doubled sheet,

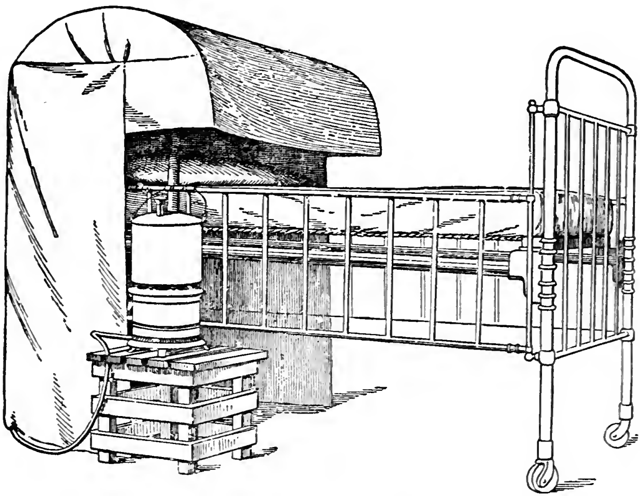

Fig. 40. Croup tent.

pleat the sheet at the sides and pin it in such manner that it will fit snugly over and around the frame as in the illustration, double another sheet and pin it to the first around the back and sides, as shown in the illustration.

To adjust a canopy like that in Fig. 41, spread two sheets on a table, right sides together, pin them down the center, putting the pins not more than one half inch apart; fold each sheet back upon itself; cover the top of the frame with a piece of old blanket, pin it over the bars of the latter. Drape the sheets over

the frame and around the bed as shown in the illustration, do not put the pins, especially at the top of the side fold more than an inch apart, and stick them through the sheet into the blanket allowing only the heads to show. Remove one or two pins from the

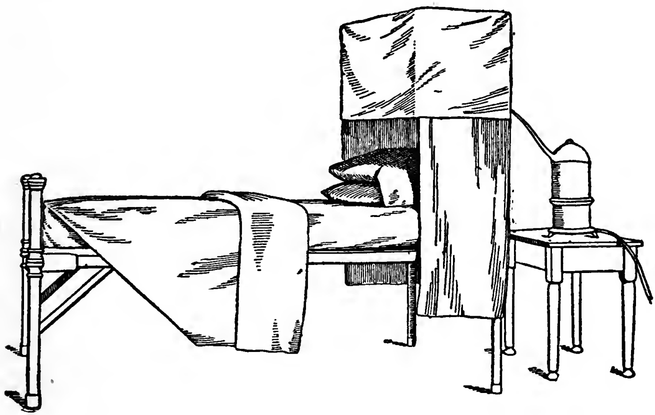

Fig. 41. Croup tent.

seam to allow for the entrance of the spout; this must be at a distance from the patient's head and the spout must not be inserted more than half an inch.

To use a screen as a foundation stand one behind the top of the bed with its wings projecting around the sides, pin doubled sheets on the inside of the screen, pin a piece of blanket across the top, pin it in place, cover it with a folded sheet, allow the latter to hang in front, and fold it around the sides, as in Fig. 41.

A large bed cradle can also be used as a foundation. To use one, stand it on one end at the head of the bed, behind the pillows, tie it to a bar of the bed to

secure it in place, pin a piece of blanket so that it will be stretched tightly across the top and arrange sheets over the top and around the sides as in either Fig. 40 or Fig. 41.

Fill the kettle to about three quarters its capacity with boiling water and place it in position. Do not add the drug to the water until the latter is boiling and be careful not to put it near the flame for almost all drugs used for this purpose are very inflammable.

Demonstration 78

Application of Medication to the Throat

Requisites: 1. Tongue depressors.

2. Swabs.

3. Receptacle for used swabs.

4. A small glass.

5. A bottle containing the drug or, for class, water.

The pupils should take turn in being *patient*, or else, standing in front of a mirror, each one should go through the procedure on herself.

The principal points to be considered are: To depress the tongue properly; to thoroughly swab the affected parts, but, if an irritant drug is used, not other parts of the mouth and throat.

To depress the tongue properly means that the curve at the back, which hides the lower part of the pharynx, is to be lowered without touching the back of the throat as this will gag the patient; therefore, get the patient in a good light and put the tip of the depressor upon the highest part of the curve and press it downward.

Procedure: Pour a little solution into the glass, arrange the patient so that the interior of the throat will be well lighted (see Chapter VII), wet a swab—do not take up so much liquid that it will drop in the mouth—depress the tongue, pass the swab over the affected parts with considerable pressure.

Demonstration 79

Application of Medicine to the Eyes

Requisites: 1. Medicine dropper.[1]

2. Swabs.

3. Receptacle for used swabs.

4. Drug that is to be used; this, for class, can be boric acid, 2%, or sterile water.

Procedure in applying drops to the eye: Place the patient with her head tilted slightly backward; take up as much of the drug in the dropper as required, but leave the latter in the bottle. Draw down the lower eyelid with the first finger of your left hand and tell the patient to look upward. Take the dropper in your right hand and, holding it slightly above, but not touching[2] the eye, make very slight pressure on the rubber nipple so that the number of drops prescribed will fall on the inner surface of the lid. Release the lid slowly and tell the patient to close her eye. The medicine applied in this way will enter the eye quite as well as if it is dropped directly on the eyeball and cause less irritation.

[1] Special droppers with flat rims are to be had for this purpose, but ordinary ones will answer the purpose.

[2] On no account should the dropper be allowed to touch the eye for the cornea is very easily irritated and injured.

To apply ointment to the eyeball put the amount of ointment prescribed on an applicator. Separate the lids by placing a finger above the upper lid (over the frontal bone) and the thumb below the lower one and make the necessary traction. Rub the ointment on the under surface of the lids and be careful not to let the applicator touch the eyeball. Tell the patient to alternately close and open her eye several times so as to spread the ointment over the eyeball and then, to assist in doing this, give a very gentle massage over the lid.

CHAPTER XIV

Counterirritants and Other External Applications

Nature of counterirritation and hyperemia. Nature, uses, and classification of counterirritants. Methods of preparing and applying poultices, sinapisms, fomentations, liniments, ointments, plasters, cold applications. Use of the cautery and flatiron to produce counterirritation. Cupping. Means of applying bandages to induce hyperemia.

External applications to the skin are made to obtain both local and systemic effects. A large proportion of the drugs and agents used for the latter purpose do so by counterirritation.

By counterirritation is meant, in a restricted sense, *an irritation produced to relieve an existing irritation*, but the term is also used when the irritation is produced to relieve other conditions as, for examples, tympanites and shock.

Though the application of irritants to the skin for the purpose of relieving irritation, pain, congestion, etc., in underlying, and even remote viscera, with no structural connection with the area of application, is a very old form of treatment, the way in which these remedies act is as yet, especially as regards the relief of pain, but imperfectly understood. It has been proven, however, that the various effects are produced through the intervention of the nervous

system, chiefly, it is thought, as the result of the conditions and actions mentioned in the following paragraphs:

1. The arrangement of the nerve-cells in the gray matter of the brain, spinal cord, and sympathetic ganglia which allows of (a) direct nerve connection between certain areas of the body surfaces and certain viscera; (b) the rapid transference of impulses coming from the surface of the body to a large number of nerve centers from which nerve fibers extend to various parts of the body. Examples of the result of the stimulation of nerve centers by impulses coming from the skin are (a) the increased peristalsis of the intestines resulting from the application of stupes to the abdomen; (b) the contraction of blood-vessels in a deep-seated, congested viscus by the use of an ice-cap.[1] Experiments have shown that the effects of hot and cold external local applications must be almost, if not entirely, reflex (*i. e.*, as just described), because they cause little or no change of temperature in the viscera.

2. Irritation of a part as the result of nerve reflexes may induce an increase in the amount of blood in the irritated area and, therefore, lessen the amount in other parts. This action is particularly marked when heat, especially moist heat, is the irritant used, because this causes expansion and softening of the tissues and dilation of the blood-vessels in the part to which the application is made (how it does so was described in Chapter VI) and this is favorable for the influx of an extra amount of blood.

The relief of pain by counterirritants is partly due to lessening of congestion or to the conditions de-

[1] Cold is not a typical counterirritant; see page 187.

scribed under hyperemia, but it is thought to be also dependent upon the central nerve connections mentioned in Section 1, though how stimulation of the cerebrospinal centers by the counterirritant lessens pain is unknown. Experiments have shown, however, that the nerve fibers of the viscera are not in direct communication with the areas of the brain that cause a consciousness of pain and thus pain referred to a viscus must be due to reflexes started in that organ which stimulate neurones in the cord from which impulses pass to areas in the brain that interpret the sensation of pain.

3. Psychic or suggestive effects induced by the treatment probably have a beneficial influence in some cases.

The chief uses of counterirritants are:

1. To relieve congestion and inflammation, as in tonsillitis, pneumonia, dysmenorrhea, headache, meningitis.

2. To promote absorption of serous effusions, as in pleurisy, and exudates around joints.

3. To stimulate nerve centers in collapse.

4. To increase peristalsis and thus overcome tympanites.

The agents used as counterirritants produce **different stages of irritation** according to their strength and the period of their application. These stages are known as: (1) *Rubefacient* or *reddening* in which the superficial vessels are dilated and the skin reddened; (2) *vesicant*, in which small isolated vesicles are formed; (3) *epispastic* or *blistering.* If the irritation is carried beyond the epispastic stage the tissue will be destroyed and substances which do this readily are called *caustics* or *escharotics.*

It is the rubefacient stage that is wanted in the use of counterirritants, except cantharides, unless otherwise ordered, for the conditions following blistering by the majority of counterirritants are painful and often slow to heal. A blister caused by cantharides, however, if it is not too extensive and infection is prevented, causes little discomfort and heals readily.

The more commonly employed counterirritant measures are:

1. Heat. This is secured for the purpose chiefly by the use of electric pads, hot-water bags, poultices, stupes, foot baths, the cautery and flatiron.

2. Cold. This is not a typical counterirritant but it is so classed by some authorities because it attains the desired effects through nervous reflex action. The nature and results of its action were described in Chapter VI.

Cold is secured for the purpose by the use of ice-caps, iced-water coils, cold compresses.

3. Irritant drugs as mustard, iodine, guiacol, chloroform, cantharides.

4. Cupping.

Though cold and heat are sometimes prescribed in the treatment of inflammations they should not be employed without the advice of a physician, especially over superficial inflammatory processes, because, though their effects are good in some cases, they may be very harmful in others, for cold lessens the natural resistance of the tissues to the causes of the inflammation, and heat, especially moist heat, softens the superficial tissues and thus may hasten suppuration.

Hyperemia signifies excess of blood in some part of the body. In the use of some counterirritants, especially heat, a hyperemia is induced at the area

of application, but when the part that is in an abnormal condition is deeply seated, as for example, in the lungs, the hyperemia is only of value in that it tends to lessen that in the viscus when it interferes with its functioning. The producing of an intensive hyperemia at the site of an infection has, however, become a common form of treatment in inflammatory processes since Professor Bier of Berlin advanced the theory that inflammation (which is a hyperemia) is one of nature's means of defense and that to increase the hyperemia is to augment the amount of the body's natural defensive agents at the site of infection, for these agents—the phagocytes and their alexins, opsonins, antitoxins, etc.—are in the blood.

Purposes of hyperemia, other than providing substances to fight the bacteria as described in the preceding paragraph, are: to lessen pain; improve the condition of the tissues, and, after active inflammation has ceased to promote resolution[1] and the absorption of inflammatory exudates.

The two objects last mentioned are attained by improvement in the circulation; the lessening of pain is thought to be due to dilution of the toxins produced by the bacteria and, sometimes, to a partial anesthesia caused by the pressure of the appliance inducing the hyperemia, which interferes with the passage of impulses along the stimulated nerve fibers, or, when heat is used, the softening and expanding of the tissues in consequence of which the pressure upon nerve endings is lessened.[2]

[1] The softening of inflammatory exudates. The softening is favored by ferments set free from disintegrated leucocytes and absorption by improving the circulation.

[2] The symptoms of inflammation, which are pain, heat, redness, swelling, and interference with functioning, are largely due

The measures generally employed to induce hyperemia for the relief of inflammation are: (1) An elastic bandage applied tightly enough to interfere with the venous, but not the arterial, circulation; the hyperemia thus induced is termed *venous* or *passive hyperemia.* (2) Heat, preferably superheated air, obtained by the use of hot-air baths as described in Chapter VI. Hyperemia induced in this way is spoken of as *active hyperemia* because it is brought about by dilation of the blood-vessels in the part and the consequent influx of extra blood; it is more especially used in the treatment of (a) chronic inflammations or those associated with injuries, as fractures; (b) after the subsidence of acute infections to hasten the absorption of exudates; (c) in acute infections to hasten suppuration when this is inevitable. Poultices are sometimes used for the latter purpose. (3) Cupping, which consists in the application of a cup or cups in which a vacuum has been created. As the result of the vacuum in the cup the tissue is forced into it and becomes engorged with blood, as is shown

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to the increased amount of blood sent to the part in response to irritation such as that produced by the toxins of bacteria or injury to the tissues. The pain is the result of stimulation of nerve endings by the toxins, or other irritant, and the pressure upon them resulting from the increased amount of blood. The degree of pain is determined chiefly by the amount of tension that is induced, *e. g.*, a slight infection in the finger where, owing to the small amount of soft tissue between the skin and bone, tension easily becomes excessive, is likely to give rise to more intense pain than a much more severe and extensive infection in, for example, the abdomen. It can thus be seen why the pain of inflammation can be reduced both by lessening the amount of blood in the part (as by the application of an ice-cap, or a counterirritant applied to a distant part, or position, see page 94), and by hyperemia.

by its red color. This means of inducing hyperemia is sometimes used over infected wounds, abscesses, and the like, because pus, as well as blood, is forced to the surface.

Demonstration 80

Preparing and Applying Poultices

A poultice, or cataplasm, is a soft, hot, moist paste for external application. Anything that can be made into such a paste and that retains heat well may be used for the purpose, but flaxseed, or, as it is sometimes called, linseed, is usually preferred for it answers these requirements particularly well. Antiphlogistin or the *clay poultice* (a preparation consisting of kaoline, glycerine, boric acid, oil of peppermint, methyl salicylate, and thymol) is also considerably used.

Requisites for demonstration: 1. Flaxseed.
2. Baking powder or sodium bicarbonate.
3. Mustard.
4. Boiling water.
5. Cup measure.
6. Utensil provided for cooking poultices in.
7. Stove.
8. Spatula.
9. Tablespoon.
10. Towel.
11. Board[1] or large platter.
12. Oil muslin or flannel cut the size and shape[2] required for the poultice.

[1] A board about eighteen inches square and one half inch thick.

[2] Poultices for the chest intended to influence the lungs should be shaped as in Fig. 42, that they may fit around the neck and extend over the sides.

13. Binder and pins.

14. Gauze or thin muslin on which to spread the poultice. For a square or oblong poultice this can be cut twice the size that the poultice needs to be,

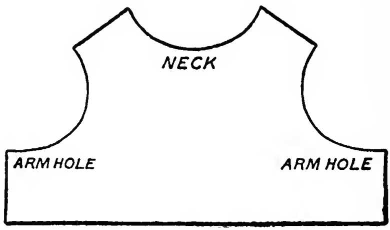


Fig. 42. Shape of poultice to cover chest.

plus about three inches to allow for turning over the edges of the paste, which is spread on one half of the material and covered with the other half, but when

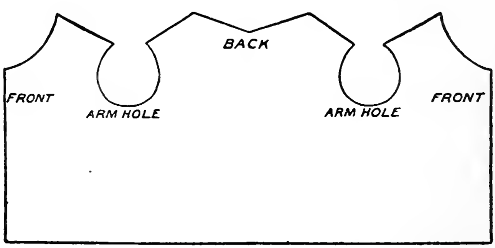


Fig. 43. Shape of binder to retain poultice in place.

any complex shape is needed (*e. g.*, for the chest) it is well to have fairly firm muslin for the foundation and gauze or thin muslin for the cover and to cut these the required shape. See Fig. 42. Cut the foundation two and the cover three inches larger on all sides than the finished poultice needs to be.

15. A quilted pad with which to cover the part

after the removal of the poultice. This is usually made of wadding or non-absorbent cotton covered with gauze. It should be the shape of the poultice.

16. Oil or vaseline and a gauze or cotton sponge to apply it with and a dish to put the latter in after use.

The points of special importance to consider when making a poultice are: To have it as light[1] as possible and as hot as it can be used without burning the patient; to make it of a consistency that will allow of its being spread easily, but not so thin that it will spread of itself and thus run from the covering.

Flaxseed Poultice

Procedure: Put the water to boil (about one and a half pints will be required for a medium-sized poultice for the chest).

Spread a towel on the board and on this lay the oil muslin or flannel; cover the latter with the gauze or muslin on which the flaxseed is to be spread.

When the water is boiling forcibly, add flaxseed to it slowly (do not allow the water to stop boiling), and stir the mixture with the spatula as you do so.

When the paste is just thick enough for some dropped from the spatula to retain its shape for a minute add about one third of a tablespoonful of baking

[1] A poultice to cover the chest should not be more than half an inch thick, for a weight on the chest may interfere with breathing. A small poultice can be about three quarters of an inch thick. Baking powder or sodium bicarbonate added to a poultice, by liberating gas (CO_2), make it lighter, and it is thought that, as gas is a poor heat conductor, they tend to assist in the retention of heat.

powder or sodium bicarbonate and beat the mixture thoroughly.

Turn the poultice on to the muslin and fill the pan with hot water.[1]

Spread the paste on the muslin to within two inches of the edges as quickly as possible. Turn up the edges of the muslin over the paste.

Cover the latter and turn the edges of the cover between the foundation and protector (*i. e.*, the oil muslin or flannel).

Fold the poultice, including the protector, and wrap the towel around it.

Wash and put away the cooking utensils.[2]

Carry the poultice (folded in the towel) and the binder and pins to the patient.

To apply the poultice: Turn back the bed covers as much as necessary and slip the binder under the part to which the poultice is to be applied.

Turn back the nightgown as much as required and if the patient is old or a small child rub some oil or vaseline over the area to which the poultice is to be applied. Cover the part with the towel that is around the poultice.

Test the temperature of the poultice with the back of your hand.

Slip the poultice under the towel, but do not unfold it all at once. Keep raising and lowering it until the patient becomes accustomed to the heat.

[1] If the flaxseed is allowed to dry in the pan the latter will be much harder to clean.

[2] If the poultice is boiling when turned on to the muslin and spread quickly and the utensil washed and put away speedily, it is quite possible for this to be done before the poultice becomes cool enough to be applied.

Notice the color of the patient's skin and judge by this, rather than the patient's opinion, if the poultice is too hot. If it does not cause a very intense redness,[1] spread it out over the part, remove the towel, and secure the binder; do not, however, fasten it tightly, especially around the chest, as this may interfere with breathing.

Fold the towel and keep it to roll the poultice in when the latter is removed.

A poultice should not be left on longer than three quarters of an hour, for by that time it will be no hotter than the skin and thus of no further value.

To remove a poultice: Take the quilted pad or a fresh poultice, towel, oil, and pledgets to the bedside. Cover the poultice that is on the patient with the towel, moving the bed covers and nightgown out of the way as you do so.

Remove the poultice from under the towel and dry the skin by rubbing your hand over the towel.

Look at the skin and, if it is very red, rub some oil over it.

Put on the pad or fresh poultice and when it is in place remove the towel and wrap it around the poultice that is to be taken away.

Mustard Poultice

To make a mustard poultice: Proceed as for a plain flaxseed poultice, but dissolve some mustard in

[1] This should always be the guide when making hot applications of any kind, because some skins will blister much more readily than others, and, if a patient is in pain, heat, even intense enough to burn, may be a relief, while on the other hand, some patients will object to even a moderate degree of heat.

tepid water, using for an adult one tablespoonful of mustard for each cup of flour, and for a child half this amount of mustard, and, just before adding the baking powder or soda, pour in the dissolved mustard.

For the reasons given on page 437, when mustard is added to anything the temperature of a flaxseed poultice, the counterirritant action of the mustard is much diminished, but it does add slightly to that of the poultice.

Antiphlogistin Poultice

An antiphlogistin poultice, because of its ingredients other than the kaoline and glycerine, was formerly thought to have special counterirritant action in addition to that due to heat, but this is now considered doubtful.

To prepare an antiphlogistin poultice put as much of the material as will be required into a bowl or jar and cover this and stand it in a pan of boiling water. Keep the water boiling until the antiphlogistin is considerably hotter than could be borne by the skin (to allow for cooling) and then spread it on a piece of muslin.

Apply it in the same manner as a flaxseed poultice; use a bandage or binder to retain it in place, and, in order to maintain its temperature, put a hot-water bag or electric pad against it, or, if these would be too heavy, protect it with oil muslin or flannel in the same way as a flaxseed poultice.

When it was considered that the ingredients of antiphlogistin had counterirritant value, it was customary to leave the poultice in place until it became uncomfortably dry, which, usually, it did

not do for several hours; but it is now generally removed when it becomes as cool as the skin, which, unless the poultice is covered with an electric pad or hot-water bag, will be in about three quarters of an hour.

Demonstration 81

Preparing, Applying, and Removing Mustard Sinapisms

Requisites: 1. Mustard leaves.
2. Mustard.
3. Flour.
4. Tepid water.
5. Oil.
6. Bowl.
7. Spatula.
8. Tablespoon.
9. Plate.
10. Gauze.
11. Two towels.
12. Basin of warm water.
13. Washcloth.

These will not be needed until the paste is to be removed

Mustard is used as a counterirritant in baths, poultices, and sinapisms.

The counterirritant action of mustard is due to a volatile oil which is developed in the mustard by the influence of a ferment when the mustard is wet. This ferment is destroyed by a temperature of 140° F. (60° C.) and its action inhibited at a considerably lower temperature, so that if mustard is added to a

substance with a temperature above about 106° F. the amount of oil developed (and hence the counter-irritant action of the mustard) will be limited. The ferment seems to become less active when mustard is kept for any length of time, especially in hot weather, and thus in summer and hot countries it is usually necessary to use relatively more mustard for sinapisms and baths than in cold weather.

The sinapisms in common use are mustard leaves and pastes.

Mustard leaves

Mustard leaves as bought consist of mustard combined with resinous material which holds it to a paper or muslin foundation.

To prepare a leaf for use, dip it in tepid water, fold it in a gauze compress, arranging the latter with only one thickness over the mustard surface. Lay the leaf, mustard surface uppermost, on a folded towel. Leave this towel in place when you apply the leaf as it will protect the patient's nightgown and the bed covers from the moisture. It is rarely necessary to secure a sinapism in place and, usually, it is better not to do so as, if it is loose, the color of the skin can be more easily watched, which is imperative, for mustard blisters some skins very readily.

Remove the leaf when the skin is well reddened. This is usually in about twenty minutes, but, sometimes, in ten or even less. Wash the skin with warm water and dry it. Make sure that no particles of mustard adhere to the skin for, if this happens, blisters may be formed. If the skin is very red, apply some oil or other lubricant.

Mustard Pastes

Mustard pastes are usually made of mustard, flour, and tepid water, and, sometimes, oil is added for it inhibits blistering. The relative proportion of mustard to flour required varies for the reasons given on page 437. Ordinarily, in a temperate climate, about one part of mustard to three or four of flour is necessary for an adult and one to six or eight for a child. About five tablespoons of material are needed to make a paste six inches square.

Procedure: Put the mustard in a bowl; crush all lumps.

Add the flour and mix the two ingredients thoroughly.

If oil is to be used, add about two teaspoonfuls.

Add enough tepid water to make a paste that can be spread easily, but that will not run.

Lay a gauze compress on a plate and spread the paste in the center of the former, about one eighth inch thick. Fold the edges of the gauze over the back of the paste.

Place the paste, the side with single layer of gauze uppermost (this is the side that goes next the skin), on a folded towel. Put it on the patient and take the same precautions while it is on and when removing it as for a mustard leaf.

Demonstration 82

Application of Stupes or Fomentations

A stupe or fomentation consists of flannel or other soft material wrung out of very hot water for the

purpose of supplying external heat to a part of the body.

Requisites for abdominal stupes, Method 1:

1. A gas or electric stove and a tray on which to stand this and, if the table on which this is to stand will be injured by heat, something (as wood or a folded towel) that is a poor heat conductor to put under the tray.
2. Matches, if necessary.
3. A basin of boiling water.
4. Oil muslin.[1]
5. Two pieces of flannel twice the size of the area for application.
6. A heavy crash towel or stupe wringer.[2]
7. A blanket or shoulder protector.
8. A rubber, if required.[3]

Requisites for Method 2. The same as for Method 1 with the following exceptions: No blanket nor stove is required; the boiling water is to be in a pitcher and the basin empty, but warmed; a binder and safety pins will be needed.

Requisites for turpentine stupes: Same as for either Method 1 or 2 plus: 1. Turpentine and oil in a glass (for proportions see page 443).

[1] This is generally used in a hospital but a piece of doubled flannel or a cotton pad can be used.

[2] A stupe wringer is a towel of heavy material, such as crash or ticking, with a fold at each end through which sticks can be run. The sticks make it easier to wring the stupes, but they are not necessary.

[3] In the author's opinion the use of a rubber under the patient is not advisable, for, if the flannel is left moist enough to wet the bed, there will be risk of burning the patient, and the absence of the rubber serves as a reminder to wring the flannel very dry.

2. A swab made by tying a pledget of absorbent cotton on one end of a glass rod.

Requisites for fomentations for the eyes: 1. Compresses of absorbent cotton about one and a half inches square, the number depending upon conditions, for, if there is suppuration, the same compress must not be used twice; otherwise, five or six will probably be enough.

2. A towel.

3. A bath thermometer.

4. A pitcher of boiling and one of cold water or whatever solution is prescribed.

5. A dressing basin.

6. A bag or other receptacle for used compresses.

7. If the treatment is to be continued for any length of time, a pail or jar and a stove.

8. If the treatment is for a communicable infection or following operation, gloves. These must be sterile for the latter condition.

These articles should all be arranged in convenient order on a tray.

Abdominal Stupes

Procedure for Method 1: Arrange the stove, light the gas, put on the basin of boiling water.

Double one of the pieces of flannel. Place it in the center of the towel or wringer and put as much of this as envelops the flannel in the boiling water, but leave the ends hanging over the side of the basin.

Put the blanket over the patient's chest and abdomen and turn down the bed covers to the groin. If the use of a rectal tube has been prescribed,[1] insert

[1] This prescription is common when the stupes are used to relieve tympanites as it often aids in the expulsion of gas.

it and put its free end in a kidney-basin or small bowl as feces may be expelled with the gas.

Turn the nightgown up above the abdomen. Cover the latter with the oil muslin.

Wring the water out of the flannel by twisting the two ends of the towels (or the sticks) in opposite directions. Do this until it is impossible to wring out any more water.

Remove the flannel from the towel; give it a quick shake and pass it (doubled) under the protector (be sure that it is not too hot); spread it out over the abdomen.

Place the other piece of flannel in the towel and this in the boiling water and, after three minutes have elapsed, use this flannel to replace that on the abdomen.

The stupes are to be changed without removing the protector or blanket, but you must raise these slightly each time you make a change to ascertain the color of the skin.

Continue the treatment the length of time prescribed; this is usually twenty minutes.

Dry the abdomen. Sometimes it is covered with a quilted pad or fold of flannel.

Method 2: Prepare the patient as for Method 1, but it is not usually considered necessary to replace the bed covers with a blanket on the upper part of the body, as usually the covers can be moved from over the abdomen sufficiently without uncovering any other part of the body.

Pass a binder under the patient in position to be pinned around the abdomen.

Put the flannel in the towel or wringer and this, except the two ends, in the basin. Pour the boiling water over the part containing the flannel.

Wring the stupe and apply it as in Method 1. Bring up the sides of the binder and pin it.

Change the stupe in ten or fifteen minutes (as prescribed). The treatment is usually continued from one to two hours.

Turpentine Stupes

Turpentine stupes are given in the same manner as the simple hot-water stupes plus the use of turpentine, which increases the counterirritant effect.

Sometimes the turpentine is sprinkled on the wet flannel just before applying the latter, but the safest way to use turpentine for this purpose is to mix it with oil in a small glass (using, for an adult, one part turpentine to two of oil, and one to six, or one to ten, for children), and rub this mixture over the abdomen before applying the stupe. When Method 2 is used an application is usually made before each stupe is applied, but with Method 1, it is generally only made three or four times during a treatment; the number depending upon how red the skin becomes. As the oil and turpentine soon separate the mixture must be stirred before each application; this can be done with the free end of the glass rod.

Stupes for the Breasts

Fomentations for the breasts are occasionally prescribed. They can be applied in the same manner as abdominal stupes, but holes should be cut in the stupe flannels for the nipples as these must not be covered with the hot flannel.

Eye Fomentations

Fomentations for the eyes are used in some inflammatory conditions of these organs.

Procedure: Put a towel under the patient's head. Pour some water or solution into the bowl and make it the required temperature; this is generally about 110° F.

Put in some pledgets; squeeze the water from one and put it on the eye. Change this in two minutes for a hot one. If there is any suppuration a fresh pledget must be used for each application. Continue the treatment the required length of time and keep the solution at the prescribed temperature.

If both eyes are to be treated use separate bowls and compresses for each eye and squeeze the compresses for each eye with a different hand.

Demonstration 83

Methods of Using Hot-Water Bags, Electric Pads, Plasters, Ointments, Liniments, Cautery, Flatiron, Ice-Coil, Ice-Caps, Cold Compresses

Requisites[1]: 1. Electric pad.

2. Cantharides and belladonna plasters, oil muslin, adhesive plaster, scissors, oil, catharidial collodion, swabs, bag or other receptacle for used swabs, etc.

3. Gauze compresses, ointments, spatula.

4. Liniments.

5. Cautery.

[1] The articles required for different procedures are listed together.

6. Flatiron, piece of flannel about half a yard square.

7. Ice-cap, ice, appliances for cracking ice.

8. Ice-coil, a large irrigator, and a clamp for the tubing of the coil, or else a funnel and pitcher and pail, ice and water in the irrigator or pail, a stand for the irrigator, an empty pail, small strip of adhesive plaster.

9. Two dressing basins, one enough smaller than the other to be inverted in it, lump of ice, absorbent cotton, bag or other receptacle for used compresses, dressing towel.

Hot-Water Bag

The method of filling and protecting a hot-water bag has been already described. Special points to remember when using a bag for the relief of pain are: (1) That, as a rule, only a small amount of water is to be put in, for a bag used for this purpose is generally needed as light as possible. (2) On no account is a patient's judgment to be relied on for the suitability of the temperature; this must be judged by the color of the skin, since as already stated, when a person is in pain, intense heat, even sufficient to cause blistering, is often a relief.

Electric Pad

An electric pad is sometimes substituted for a hot-water bag. Two points to remember about such pads are that (1) their temperature is likely to increase beyond a safe degree when the current is turned on for a long time; (2) it is necessary to examine old pads before using them to see that their insulating

material is intact; bedclothes have been set on fire by defective insulating material.

Liniments

Liniments are liquid or semi-liquid preparations of drugs (chiefly counterirritants) dissolved, as a rule, in alcohol or some oily substance.

To apply liniment place the patient in a comfortable position with the part to be treated exposed; pour a little liniment on the part (do not let the bottle touch the skin while doing so) and rub it over the skin with your hand, using as much pressure as the patient can stand. Continue the treatment for about ten minutes.

Guiacol and glycerine, though not strictly a liniment, might be mentioned here. It is a counterirritant preparation that is considerably used for the relief of pain in arthritic joints. It is painted over the surface with a cotton swab. The application must be very thin, otherwise it will blister. Should too much be used, remove it by washing the part with alcohol or glycerine. After the application dries the part is usually covered with absorbent cotton or wadding and bandaged.

Ointments

Ointments are preparations of drugs in some fatty base as lard, cold cream, or vaseline. The majority of drugs used in this way are either emollient or astringent; two important exceptions are mercury and belladonna; for the action of these drugs see Materia Medica.

Ointments are used: (1) to ameliorate abnormal conditions of the skin; (2) that they may be absorbed and produce either systemic or local effects after absorption. Mercury and belladonna are the drugs most frequently used for the latter purpose, but very few drugs are absorbed through the skin. Mercury is thus administered, as a rule, when it cannot be taken by mouth, and belladonna, because, when absorbed, it depresses the secretory nerve endings and, to a slight extent, the sensory, in the underlying parts.

For local effect an ointment is usually either spread on gauze or lint and secured to the part to be treated with a bandage, or if the part is exposed, as the face, the ointment may be applied directly to it and left uncovered.

When the drug contained in the fatty base is intended to be absorbed it is usually rubbed into the skin. This is known as *inunction.*

Points to remember in the application of ointments:

Always use a clean spatula or other appropriate utensil to take ointment from a jar, *never the fingers.*

Before applying an ointment that is to be absorbed, wash the skin with warm water and soap and, when possible, ether to remove sebaceous matter, which interferes with absorption; rub sufficiently, and use enough hot water to make the skin red, for this color is due to an increased amount of blood in the part and this favors absorption.

Wear a rubber glove or finger cot when giving mercury inunctions, because (1) otherwise, in rubbing you will absorb some of the ointment and the patient will not get the full amount ordered and the drug might prove harmful to a person who did not require it;

(2) patients getting such inunctions usually, though not always, have syphilis.

Mercury is irritating to the tissues and, therefore, applications must not be made in the same place until four or five days have elapsed. In order to prevent this, record the place in which an inunction is made on the patient's chart.

The sites chosen for inunction when the drug is intended to be absorbed by the blood and carried through the body are those parts of the body where the skin is thinnest, such as the inner surfaces of the thighs and elbow joints, the groins, and axillæ, but if the drug is intended to affect a superficial localized area the ointment is applied directly above this point.

Belladonna ointment is most commonly applied to the breasts to check the secretion of milk. When applying it, unless massage has been also prescribed, use very little pressure and, following the inunction, spread some of the ointment on a piece of lint or a gauze compress, cut holes in this for the nipples, and apply it to the breasts. If a *tight binder* is to be also used, as is generally the case, put some cotton around the nipples before pinning the former to prevent pressure being made upon them.

Plasters

Plasters are preparations of drugs combined with some resinous substance which is spread upon, and adheres to, muslin or other foundation. The plasters in most common use are mustard, cantharides, and belladonna. The use of mustard has been already discussed; belladonna plaster is used for the same purposes as the ointment; cantharides is used as a vesicant.

Prepare the skin for the application of a belladonna plaster in the same manner as for an inunction, but the same preparation must be made for a cantharides as for an incision (see page 290).

To apply either of these plasters, heat them slightly (this can be done by putting them in a warm oven for a few seconds or under the lighted burner of a gas stove, about three inches from the flame), oil the medicated surface of a cantharides by brushing

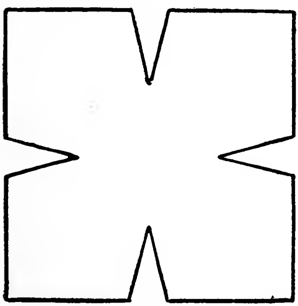


Fig. 44. Oiled muslin cut for cap.

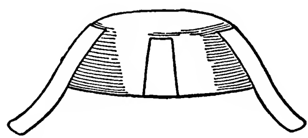


Fig. 45. Cap formed by bringing cut edges together with adhesive plaster and cutting off the corners of the muslin.

it with a swab wet with sterile oil, lay the plaster on the skin, run your hand lightly over the upper surface; a belladonna plaster will then adhere to the skin, but a cantharides usually requires to be fixed in place or in some way protected from being brushed off by the bed covers or clothing. It must not, however, be strapped down tightly. A bandage can be used for the purpose or a *cap* made as follows: Take a piece of oil muslin somewhat larger than the plaster that is to be used, cut a triangular piece out of each side, as shown in Fig. 44, arrange the cut edges of

each side together with strips of adhesive plaster (see Fig. 45), have three of the strips about three inches longer than the *cap*, cut the corners of the *cap* so as to make it round as in Fig. 45.

Put the *cap* over the plaster and secure it in place with the strips of adhesive plaster. One side is left free so that it can be raised and the skin watched for the appearance of a blister. This usually forms in from four to eight hours, but will do so sooner on some skins and not even in eight hours on others, but a cantharides plaster is never left on longer than eight hours.

A very important point to remember regarding the use of cantharides is that it is absorbed through the skin and eliminated through the kidneys and irritates these organs as well as the skin; for this reason, as well as to avoid having a larger blister than necessary, always get a definite statement from the doctor regarding the size of the plaster he wishes used; this is generally from one half to two inches and does not exceed three inches.

When removing a cantharides plaster, be careful not to break the skin; remove any adhering particles of cantharides by washing the part gently with oil. Occasionally, though not as a rule, the physician wants the blister cut so that the fluid in it can escape. When this is the case, make a slit in its lowest corner with sterile scissors, hold a sterile compress below the incision to catch the escaping fluid, and make slight pressure above the bleb with a sterile sponge to promote the escape of the fluid. Whether the blister is opened or not it is usually covered with a sterile gauze compress or a cap such as that just described to protect it from dirt and the friction of clothing, etc.

To apply cantharidial collodion wash and disinfect the skin as when using a plaster; outline the space to which the vesicant is to be applied with oil, in order to prevent the latter spreading; paint a thin coating of the collodion over the prescribed area with a sterile cotton swab. After the blister forms, remove the collodion by patting the part gently with a sterile gauze sponge wet with ether. Treat the blister in the same way as that caused by a plaster.

Heated Metal

A flatiron is sometimes used as a source of heat and counterirritation in the treatment of lumbago and similar maladies because the pressure made with the iron helps in alleviating the pain. To use one, dry the skin of the area thoroughly, cover it with a piece of flannel, and pass a heated iron back and forth over the latter for about twenty minutes. Have the iron as hot, and make as much pressure, as the patient can bear. It may be necessary to make light pressure at first and increase it gradually. Raise the flannel from time to time to see that the skin is not becoming too deep a red.

A thermo-cautery or an electric cautery is occasionally used to promote counterirritation. The cautery is generally used by the doctor and the nurse's duties consist in preparing the patient and the cautery. To prepare the patient place her in a comfortable position with the part that is to be treated exposed, dry the skin, or if a blister[1] is to be made, wash and disinfect it.[2]

[1] This is now very rarely done.

[2] Ether and alcohol must never be used for this purpose.

The essential parts of the cauteries used for this purpose are a hollow metal tip and arrangements for heating this. To do this with an electric cautery usually merely requires making connections for the passage of the electric current, but the Pacquelin's thermo-cautery is more complicated. In this appliance the tip screws into a metal tube which serves both as a handle and as a reservoir for a small sponge which, before the cautery is used, is wet with benzine; on the other end of this tube a piece of rubber tubing connected with two bulbs is attached. One of these, known as the air reservoir, is of very soft rubber and is covered with netting to prevent its too free expansion, the other is of thicker rubber. By squeezing the latter occasionally air is pumped through the tubes and forces benzine vapor into the hollow tip and, after the tip is heated by holding it in a flame, this will maintain its temperature. Care must be taken not to pump in too much air or the rubber reservoir may burst; this should never be distended to its full capacity. Care must also be taken not to let the heated tip come in contact with anything, both because it will scorch or burn anything inflammable and because the tip, when heated, is easily dented. When the cautery is used as a counterirritant it is not allowed to touch the skin but is passed back and forth above the part being treated until the latter is well reddened.

Methods of Using Cold Applications

As previously stated, the appliances most frequently used for cold applications to limited areas are ice-caps, ice-coils, and cold compresses.

Ice-Caps

The special points to remember in connection with the use of ice-caps are: 1. To break the ice into pieces about the size of a walnut; if the pieces are larger than this the cap is not likely to fit over the part well, if smaller they will melt too quickly.

2. Let some hot water run over the ice to blunt the sharp edges which might pierce the rubber.

3. Roll up the sides of the cap before putting in the ice, and, after doing so, squeeze it above the ice, to expel the air.

4. Do not fill a cap more than three quarters its capacity and not even this much when its weight will cause discomfort. Envelop it in a gauze or muslin protector.

5. If the weight of a cap annoys the patient tie the cap to some support such as shown in Fig. 16 or to a bed cradle and place this so that the cap will barely rest upon the part.

The care of ice-caps after use was described in Chapter I.

Ice-Coils

Ice-coils consist of rubber tubing about one quarter of an inch in diameter held in a coil with narrow bands of rubber[1] and having two loose ends about two yards long for the passage of ice water to and from the coil.

[1] A coil can be improvised in emergency by coiling tubing in the same manner as the bought coils, putting three or four rows of tape on each side of the tubing (to take the place of the rubber bands) and stitching the tapes opposite each other together at the lower edge of each circle of tubing.

To use a coil, place the stand for the reservoir by the bedside, and if the latter has an outlet at the bottom, before filling it with water and ice, put a clamp on the end of tubing coming from the center of the coil and attach the tubing to the reservoir outlet.

Place the reservoir on the stand; it should not be more than about a foot above the patient, otherwise the water will run through unnecessarily quickly.

Envelop the circular portion of the coil in gauze and place this on the affected part.

Place the empty pail at the side of the bed and put the end of the tubing extending from the outside of the coil into this, and it is well to secure it in place; this can be done with a small piece of adhesive plaster.

Open the clamp and let the water run slowly through the coil.

If the reservoir has no outlet at the bottom it will be necessary to get the water through the tubing by siphonage. To do this: Put a funnel in the end of the tubing coming from the center of the coil, hold this and the end of the tubing extending from the outer part of the coil in the left hand, pour water from the pitcher into the funnel until it and the tubing of the coil are filled, then compress the tip of the free end of the tubing against the funnel, put down the pitcher, take the free end of the tubing in your freed hand and, simultaneously, lower this into the empty pail and the funnel into the reservoir. Do not allow the water to run from the tubing or the funnel until the latter is inverted in the water.

The rest of the procedure is the same as when a reservoir with a lower outlet is used.

Cold Compresses

The only cold compresses that need be described here are those for the eyes. These are usually of absorbent cotton cut a little larger than the eye.

Place the compresses on a tray covered with a towel. Put a bag or other utensil in a convenient place to receive used compresses. Invert a small bowl in a larger one and place a lump of ice on this.[1] Put a little water in the bowl. Wet some compresses with the water and place them on the ice. Use these compresses in the same manner, observing the same precautions, as the eye fomentations, see page 444.

Demonstration 84

Cupping. Application of Bandage to Induce Hyperemia

Requisites: 1. A tray containing the articles required when the vacuum is created by heat, viz.: (a) Cupping glasses,[2] the number depending upon the purpose for which they are used; if a considerable area is to be covered, as when the treatment is for relief of congestion of the lungs or kidneys, six or eight will be needed; (b) an alcohol lamp, a glass[3] containing about half an ounce of alcohol; (c) a metal rod with a swab of absorbent cotton on one end, and absorbent

[1] The ice is thus kept above the water and will not melt as quickly as it otherwise would.

[2] In the hospital special thick-rimmed glasses are provided, but any small smooth-edged thick glasses will answer; thin glasses are not suitable as they might be broken and cut the patient during their application.

[3] This glass must not be the same as the cupping glasses for, if it were, the ignited rod might be put into it by mistake.

cotton with which to make fresh swabs; (d) a receptacle for used swabs; (e) a glass containing water with which to extinguish swabs before changing them; (f) matches; (g) a towel; (h) a gauze compress.

2. (a) Bier's cups; (b) vaseline or oil; (c) swabs for applying the latter; (d) a receptacle for used swabs; (e) soap; (f) a gauze or muslin bandage. When a cup is used over a wound, it, the oil and swabs must be sterile.

3. A rubber bandage.

Cupping consists in the application of glass[1] cups in which a vacuum has been created. As the result of the vacuum the tissue under the cups is forced into them. This results in hyperemia of this tissue and the treatment is given both to obtain the local effects of hyperemia and for the relief of congestion in underlying structures as described under counterirritation.

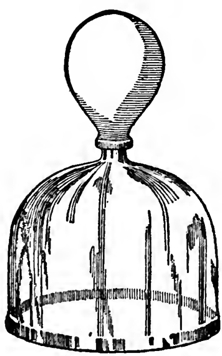


Fig. 46. Bier's cup.

The vacuum may be created in the cups by the use of heat or with a pump or rubber bulb. Heat creates a vacuum because it causes the expansion and consequent expulsion of air from a cup; a pump will create a vacuum because, when its piston is pressed down, the air in its cylinder is forced out and, when its piston is drawn back, after the cup is in position, the air in the latter is forced into the emptied cylinder. The bulb acts in practically the same manner as the pump, the air being expelled from it when it

[1] The cups are of glass so that the color of the skin can be watched.

is squeezed, and, when it relaxes, after the cup is in position, the air from the latter passes into it.

Cups provided with pumps and bulbs are known as *Bier's cups* after the inventor who demonstrated their use to induce hyperemia in the treatment of inflammations. It is for this purpose that these types of cups are chiefly used and, as a rule, only one cup is applied at a time, while cups in which a vacuum is created by heat are used more especially for counter-irritant effects and, generally, a number of them are used at a time.

A method of cupping when the vacuum is created by heat. Important points to remember are:

1. If the patient is conscious tell her something of what you are going to do, otherwise she may be frightened.

2. Do not let the rims of the glasses become heated. To avoid this have a small flame and do not let it come in contact with the rims. The size of the flame depends upon the size of the swab; this should not be longer than between an inch and an inch and a half.

3. Do not have enough alcohol on the swab for it to drip or it may do so while burning.

4. Do not use a swab after it becomes charred for burning pieces may then drop from it.

5. Watch the color of the skin while cupping and remove a glass if ecchymosis is likely to be caused.

Procedure: Arrange the apparatus. Leave the glasses with the alcohol and water, the receptacle for used swabs, and the lamp on the tray. Place the lamp and glass of alcohol in such relative position that the lighted swab will not be passed over the glass of alcohol. Put the towel across one end of the table, or if the tray is a large one, across one end of

it, but do not let it come near the lamp or the alcohol. Place the glasses on this.[1] Unless the swab has been prepared, make one by winding a thin layer of absorbent cotton around one end of the metal rod. Make sure that it is firmly in place.

Draw the patient to the side of the bed, if necessary and her condition permits; make her as comfortable as possible, and expose the part to be treated. If there is hair on the part, remove by clipping or shaving as it may take fire.

Dip the swab in alcohol, ignite it in the flame. swab the sides of a glass with it, avoiding the rim, then, quickly, place the glass on part of the area to be cupped. Repeat the procedure, using other glasses, until the prescribed area is covered.

Put out the light by dipping the swab in water. Remove the glasses; to do this, insert a finger under the rim of each glass so as to let in some air; if the glasses in which there is much tissue are pulled off without doing this pain will be caused.

Wipe the glasses with the gauze compress and repeat the procedure.

Do this for the length of time prescribed, which is generally about ten to fifteen minutes.

Wash the glasses with soap and water before putting them away.

To apply a Bier's cup with a bulb, choose one large enough to extend about an inch beyond the inflamed area; oil the edges with vaseline.[2] Place the cup in

[1] This arrangement is to prevent nicking the rims of the glasses which occasionally happens when they are put down quickly on a hard surface.

[2] This is to make the cup adhere firmly to the skin and thus prevent the entrance of air.

position and, at the same time, squeeze the bulb. As the bulb resumes its shape, if the cup has been properly applied, the tissue will rise in the glass.

To use a Bier's cup on an inflamed limb: Lubricate the skin with soap where the cuff, with which the cups for this purpose are provided, will rest; this must be slightly above the inflamed area.

Put the limb, to about an inch above the inflamed portion, in the cup and secure the cuff snugly with a bandage. Exhaust the air with the pump. Do not do this too quickly nor too thoroughly or pain will be caused. Watch the color of the skin and cease pumping if it begins to assume a mottled appearance, or if the patient complains of pain.

If there is a wound, as previously stated, the cup should be sterilized, and if the wound is covered with a dressing, this should be loosened or removed, for the congestion promoted by the treatment induces swelling of the part, and if there is pus in the wound, it will be more likely to be evacuated if the wound is uncovered.

Use of Bandage to Induce Hyperemia

Choose a rubber bandage long enough to make two or three circular turns around the part to which it is to be applied and about, for a finger, half an inch wide, and for an arm or leg, between two and three inches wide. Apply the bandage between the inflamed part and the heart, a considerable distance above the former; thus if this is a hand, put the bandage above the elbow; if a leg, above the knee. Apply it tightly enough to cause the veins below it to become

prominent and the skin a deep red color, but not so tightly that the beat of the artery cannot be felt. Feel the radial artery if the bandage is on the arm and the dorsalis pedis if it is on the leg.

CHAPTER XV

Subcutaneous, Intramuscular and Intravenous Injections. Vaccination. Aspirations. Blood-Letting

Methods of giving subcutaneous, intramuscular, and intravenous injections, salvarsan, neo-salvarsan, antitoxins, and vaccines. Nature of antitoxins and vaccines. Preparations for aspirations and phlebotomy. The nature of these operations. The use of leeches. Methods of obtaining blood for examination.

Demonstration 85

Subcutaneous, Intramuscular, and Intravenous Injections

Requisites for subcutaneous and intramuscular injections: 1. A hypodermic-tray. (The so-called *hypodermic-tray* usually consists of a glass or enamel tray holding (a) an alcohol lamp provided with an attachment[1] for sterilizing the needle and boiling the water; (b) matches; (c) a small jar containing alcohol 70%, and (d) one containing alcohol 95%[2]

[1] When there is no such attachment a silver tablespoon is used as a substitute.

[2] When a metal instrument is kept in alcohol the latter must be at least 95%, for, if it is diluted, the water will cause the metal to rust. The forceps, the jar of sponges, and the bottle of water are sterilized daily and the jar and bottle refilled.

and a small pair of forceps; (e) a small jar containing sterile sponges and swabs (f) a bottle of sterile water; (g) a small oval tray or dish; (h) a hypodermic syringe and needles.)[1] 2. Samples of drugs used for hypodermic injections, both liquids and tablets, antitoxins, and vaccines. 3. Collodion, for use after intramuscular injections.[2] 4. A bottle of sterile salt solution.[3]

Requisites for intravenous injections: 1. A tray containing the requisites for disinfecting the skin (see Chapter VII). 2. A sterile tray prepared as described in Chapter VII. containing a sterile Luer or record syringe and needles (the size required will depend upon the amount of drug that is to be given). 3. Three sterile dressing towels other than those used to cover the tray and utensils. 4. A sterile rubber bandage or a piece of small diameter rubber tubing (about one half yard) and an artery clamp. 5. Sterile rubber gloves. 6. The drug required. 7. Sterile sponges. 8. A sterile swab. 9. A sterile compress. 10. A gauze bandage.

Requisites for salvarsan injection: (1) A tube of salvarsan. (2) A file to open the tube (these are placed in alcohol so that they will be sterile when needed). (3) A flask of hot sterile salt solution, 0.5%, made from chemically pure sodium chlorid and sterile, freshly distilled water. (4) A flask of

[1] Several sizes should be provided for class.

[2] As a rule subcutaneous injections are the only ones that can be demonstrated in class, but everything should be prepared for the other injections. It is highly advisable for the students to give each other hypodermic injections for nurses should know what they feel like.

[3] The sterile water is only necessary for class. It is used instead of a drug.

hot distilled water. (5) Sodium hydroxid, 15%, in a glass stoppered bottle. (6) A medicine dropper. (7) A glass graduated liter measure. (8) A glass stirring rod. (9) A funnel with (10) sterile cotton or filter paper placed in it. (11) The articles necessary for giving the solution, these, as salvarsan is generally given as an intravenous infusion, are usually the same as those mentioned in Demonstration 75. Everything, with the exception of the articles mentioned in Demonstration 75, should be sterile.

Requisites for a neo-salvarsan injection: (1) A tube of neo-salvarsan. (2) A file to open the tube (these are placed in alcohol so that they will be sterile when needed). (3) A flask of sterile, distilled water. (4) A sterile graduated glass in which to mix the solution. (5) A sterile glass stirring rod with which to mix the solution. (6) The articles necessary for disinfecting the skin. (7) The articles necessary for injecting the solution (these may be either those required for an intravenous infusion, see Demonstration 75, or an intramuscular injection or an intravenous injection such as is described in this chapter).

Subcutaneous or hypodermic and intramuscular injections are given when (1) prompt action of the drug is required; (2) when the drug cannot be taken by mouth; (3) when the secretions of the stomach or intestine change the nature of the drug; (4) when the drug is not readily absorbed from the alimentary tract.

The difference in the nature of these two types of injections consists, as their names imply, in the depth of their introduction into the tissues, but even the subcutaneous (below the skin) injections are to be

given at a depth of about three quarters of an inch, except when the drug is used to promote local anesthesia. The reasons for this being that (1) if the drug is injected into, instead of under, the derma, it will not be readily absorbed; (2) just below the epidermis and the covering of the mucous membranes there are far more nerve endings that, if stimulated, will give rise to a sensation of pain than there are in the deeper tissues and they will be stimulated by a drug injected in their midst, unless this, as the local anesthetics do, depresses them. On the contrary, to get the best results from the majority of drugs used as local anesthetics, it is necessary to inject them where they will come in contact with the nerve endings that they are to depress.

Intramuscular injections are used as a rule in preference to the more superficial ones when a large quantity of liquid is to be given, when the drug is particularly irritating and when it is not easily absorbed, for absorption takes place more readily from the deeper tissues.

Except for a few differences in procedure that will be mentioned in the text, the methods of giving both types of injections are the same as are also the precautions that must be taken.

The dangers attending the giving of these injections are: (1) Causing an abscess; (2) breaking the needle in the flesh; (3) injecting the drug into a vein; with some drugs this would not make any difference, but disastrous results might follow the introduction of some substances directly into the blood.

An abscess is generally the result of the use of an unsterile drug or an unsterile needle or failure to cleanse the skin properly at the point of puncture

and anything which injures the tissue cells (*e. g.*, a blunt needle or an irritating drug) is a strong predisposing factor.

To avoid risk of breaking the needle in the flesh: (1) do not use a bent needle; (2) do not, if possible to avoid it, give an injection to an obstreperous patient without someone to hold her; (3) tell a conscious patient who has never had an injection what you are going to do but that it will not hurt more than the prick of a needle, otherwise, she may pull away the limb in which you insert the needle and thus break the latter; (4) do not make an injection where the needle will strike a bone.

To obviate danger of putting the drug into a vein do not make an injection along the course of the vessels and, when giving an intramuscular injection, after inserting the needle, before injecting the drug, remove the syringe and notice whether there is any flow of blood in the needle, if so remove the latter and make a new puncture.

The sites generally chosen for subcutaneous injections, other than local anesthetics and antitoxins, are, for convenience, the outer surfaces of the arms and thighs and, for intramuscular ones, the gluteal or lumbar muscles. As previously stated, injections are not to be made in the neighborhood of the large blood-vessels or over bony prominences. Local anesthetics are injected into the part where the prevention of pain is necessary; the sites chosen for antitoxin injections are mentioned on page 476.

Procedure in preparing for and giving injections: Collect your apparatus and choose a suitable syringe and needle. The size of the syringe will depend upon the amount of drug that is to be given, that of the

needle upon the nature of the drug and the way in which it is to be given. Thus, for a small amount of a clear fluid, other than a local anesthetic, the smallest needle obtainable should be used; for a local anesthetic a comparatively long needle of small bore is generally preferred, and for a thick fluid, as oil and the majority of antitoxins, a needle of large enough bore for the liquid to be forced through easily. For intramuscular injections a needle about two inches long is generally needed.

Wash your hands.

Sterilize[1] or disinfect the syringe. To sterilize it, boil it for five minutes[2]; to disinfect it, fill it with alcohol, 70%, expel the latter back into the jar, refill the syringe and put it into the jar of alcohol.[3]

Pour some sterile water into the pan or spoon. Light the lamp.

When the water is boiling take the wire from the needle and put the latter into the water. **Two important points** to remember in this connection are:

[1] When large needles, such as are used for antitoxins and vaccines, and particularly irritating drugs are introduced into the tissues extra precautions against infection are necessary (for reasons see Chapter VII) and the syringe used in such case is usually sterilized.

[2] As is the case with all glass utensils, the syringe must be put into the sterilizer while the water is cold and must not be allowed to come in contact with the metal.

[3] In some hospitals the needle is attached to the syringe before doing this and the act is repeated at least five times, holding the needle in the alcohol during the process. It is claimed that this method of disinfection is as effectual as sterilizing and that it does not tend to blunt the needle as boiling does, the needle is disinfected in the same manner after use, and is kept in a jar that is sterilized daily and contains a pad of sterile gauze on which to lay the needle.

(1) that there must be enough water in the pan or spoon to cover the needle; (2) the point of the latter[1] is not to come in contact with the former, therefore,

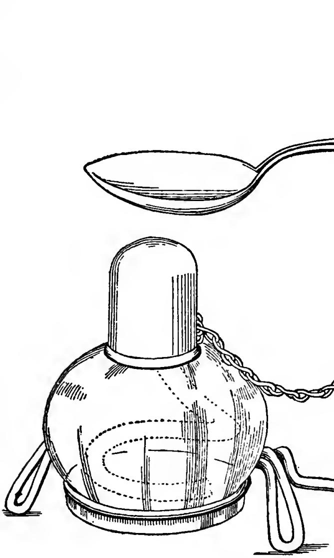


Fig. 47. Lamp and spoon-shaped pan for sterilizing hypodermic needles.

put down the screw end of the needle first. The needle is to remain in the boiling water for one minute.

If the drug is in tablet form,[2] take a sterile sponge

[1] The point of a hypodermic needle is very easily blunted and therefore it must never be allowed to come in contact with anything hard. It is to be remembered that a blunt needle will not only cause pain, but it, by injuring the tissue, will predispose to infection.

[2] Many of the drugs intended for hypodermic administration are mixed with finely powdered sugar, moistened with alcohol, and moulded into tablets.

(with sterile forceps) from the jar and shake a tablet from the bottle on to this and place it on the tray.

Eject the alcohol from the syringe and draw between five and ten[1] minims of water into it from the pan.

Put out the flame.

Take hold of the screw end of the needle with the sterile forceps and connect it with the syringe. *Nothing is to touch the part of the needle that will be inserted in the flesh.*

Remove the piston from the syringe and put the tablet into the latter, while doing so, hold the tablet with the sponge. *Do not touch it with your fingers.*

Insert the piston, as soon as it blocks the opening of the syringe,[2] turn the latter with the needle pointing upward and press the piston until a drop of water is ejected from the needle so that all air will be expelled. If air bubbles are seen in the liquid after this is done there must be something the matter with the syringe.

Shake the syringe until the tablet is completely dissolved.[3]

If the drug is a liquid fill the syringe in one or other of the following ways: (1) Draw the solution into the syringe, taking a minum or two more than required, attach the needle, turn the syringe with the needle pointing upward and press the piston, very gently, until its lower edge is on a level with the line

[1] It is a mistake to use too little water, for dilution renders a drug less irritating and favors absorption.

[2] If this is not done before the piston reaches the liquid some of it will be ejected.

[3] It is a common mistake to do this before expelling the air, but as a drop or two of liquid may be lost in expelling the air, it is obvious that the less the drug is dissolved before this is done the better.

showing the amount required; while doing this hold the mark on a level with your eye (the reason for this was given on page 409). (2) Connect the needle to the syringe and, holding the latter obliquely, pour in the drug, a minum or two more than required, and proceed as described above. This is the best method with thick liquids.

A drug that is not put up in a sterile tube or that is not diluted with alcohol or other antiseptic should, if possible, be boiled for a minute or two before use. Unfortunately, most drugs are deteriorated by heat; this is one of the objections to the use of cocaine. The drug is boiled in the same spoon or pan as the water, either before or after the needle is sterilized.

After the syringe is filled, lay it on the small tray with the part just below the needle resting on the sterile sponge; this holds the needle from contact with the tray. Take another sterile sponge with the sterile forceps, moisten it with alcohol 70%, and lay it on the tray or, for an intramuscular injection, take a bottle of iodine and one of collodion and two sterile swabs, place the latter with their covered points resting on a sterile sponge. Carry this tray and its contents to the patient.

To prepare the skin rub the part at and around the point where the puncture is to be made quite forcibly with the wet sponge, using the side that did not touch the tray, or else paint it with iodine.

To give a subcutaneous injection for other purposes than to produce local anesthesia, take up a cushion of flesh between the thumb and fingers of the left hand, keeping the skin as taut as possible, place the point of the needle on the skin and then insert it

quickly,[1] almost vertically[2] into the flesh (do not touch the piston while doing this or some of the fluid may be injected into the skin). Press the piston slowly so as to expel the fluid. Wait a second and then remove the needle quickly, making pressure on the skin near the point of puncture while doing so. Massage the part for a few seconds to spread the fluid through the tissue and so hasten absorption.

To inject a local anesthetic use, as already mentioned, a comparatively long needle, introduce it almost horizontally under the epidermis along the line where the incision is to be made and then start injecting the fluid and, slowly, withdrawing the needle so that the anesthetic will be deposited among the nerve endings along the line of incision.

To give an intramuscular injection hold the skin of the part tense by pressing in opposite direction with a finger and the thumb of your left hand and force the needle perpendicularly, steadily, and quickly, through the skin directly into the muscle. Proceed as for an ordinary subcutaneous injection, but, after the removal of the needle, paint the puncture with collodion.

A syringe and needle used for a vaccine or an antitoxin or for a patient suffering with an infectious disease must be boiled after use but, otherwise, disinfection, as described in footnote 3, page 466, is sufficient. While doing this be careful not to let the point of the needle touch the jar. Dry the needle by alter-

[1] The puncture will cause less pain if the needle is inserted quickly than if it is introduced slowly.

[2] This is for a small needle; if a long one is used for a subcutaneous injection it should be introduced at an angle of about fifty degrees.

nately inserting and removing the wire, wiping the latter with a piece of clean gauze before each reinsertion. As soon as the wire is dry when removed reinsert it and let it remain, have its point extend beyond that of the needle. It is important that the cleansing should be done as soon as the injection has been given for, otherwise, especially if a thick solution has been used, the needle may become clogged.

An intravenous injection is always given by a physician and the nurse's duties consist in preparing the utensils and the patient.

The articles required are mentioned on page 462. Prepare the needle by boiling it for one minute and the syringe, if it can be so treated, by boiling it for five minutes.[1] If a syringe cannot be boiled, disinfect it by drawing alcohol, 70%, into it and then expelling it at least six times; fill with alcohol and then leave it immersed in alcohol for ten minutes. Heat the drug to body temperature; this is usually best done by standing the ampule or bottle in a pan of hot water. The method of preparing the other utensils was described in Chapter VII.

The doctor usually fills the syringe and connects it and the needle after he has donned rubber gloves and if these procedures are relegated to a nurse she must put on sterile gloves before carrying them out, for the most careful asepsis must be maintained in connection with this treatment. If a nurse fills the syringe she must be sure that air is expelled from it; this is done in the same manner as for a hypodermic injection.

One of the large veins in the front of the elbow

[1] Put the syringe into the water while it is cold and do not let it come in contact with the sterilizer.

joint is the site usually chosen for the introduction of the drug and the preparation of the patient's arm, including the application of a bandage[1] to restrict the venous—but not the arterial—circulation, is the same as for an intravenous infusion (see Demonstration 75). It is to be remembered that if iodine is used to disinfect the skin, it is to be removed by washing the part with ether, for the iodine makes it difficult to discern the vein. Loosen the bandage when the doctor is ready to inject the drug; this will be when, after he has inserted the needle in the vein (pointing it in the direction of the venous current), he has drawn a little blood into the syringe to make sure that the needle is in the vein.

After the doctor withdraws the needle paint the puncture with collodion and apply a sterile compress and bandage.

Preparation for Injections of Salvarsan and of Neo-Salvarsan

Salvarsan is now usually given intravenously in the manner described in Demonstration 75 and neo-salvarsan as an intramuscular injection, but the latter is also given as an intravenous injection or, when more highly diluted, as an intravenous infusion. The only necessary difference between the preparation for the injection of these drugs and the methods already described is in the preparation of the drugs and this is usually done by the doctor at the time of administration.

[1] Rubber tubing is sometimes used instead of a rubber bandage and secured in place by clamping the ends with an artery clamp.

The preparation of the salvarsan is about as follows: About 40 c.c. of hot sterile distilled water is put into a sterile graduated glass measure; the file and the tube containing the drug are taken from the alcohol and dried, the tube opened with the file, and as much of the drug as required is put into the water which is then stirred or shaken until the drug is thoroughly dissolved. To this solution is now added, drop by drop, using the medicine dropper and stirring the solution between the addition of each drop, enough sodium hydroxid, 15%, to dissolve the precipitate which forms when the first drops are added. This usually necessitates twenty drops for a solution containing 0.5 gm. (7½ gr.) of salvarsan. When the solution is absolutely clear it is diluted with 0.5% hot salt solution—50 c.c. (1⅔ ounces) being used for each 0.1 gm. (1½ gr.) of salvarsan. The funnel is placed in the intravenous reservoir sterile absorbent cotton or filter paper put in the former and the solution filtered. The temperature of the solution should be about 105° F.

The preparation of neo-salvarsan consists in putting the amount of drug required into a sterile graduated measure, adding the necessary quantity of warm (about 80° F.) sterile, freshly distilled water, stirring this with the sterile glass rod until the drug is completely dissolved, and then pouring the solution into the syringe or flask from which it is to be administered. For an intravenous injection about 3 c.c. of water are used for each 0.15 gm. of the drug; for a concentrated intravenous injection about 10 c.c. of water and 0.45 gm. to 0.6 gm. of neo-salvarsan are used and, for an infusion about 25 c.c. of water are used for each 0.15 gm. of neo-salvarsan.

Sera. Antitoxins. Vaccines.

The sera used in therapeutics generally consist of the liquid expressed from clotted blood. The blood may be that of a human being or of one of the lower animals. It is usually obtained in much the same manner as described under Phlebotomy, page 492, but, as a rule, in the lower animals,[1] it is, for convenience, taken from the jugular vein. A serum may be normal, *i. e.*, obtained from a normal individual or animal or it may contain antitoxins or antibacterial (that will destroy bacterial) substances. Normal horse serum is sometimes used in hemorrhage to hasten the clotting of blood and in some disease to increase leucocytosis; also, normal serum is used as a diluent for some vaccines and other medicinal substances, but the majority of sera used in therapeutics are what are known as *antitoxin sera.*

An antitoxin serum is one that is obtained from the blood of a person or animal who has recovered from a disease that gives rise to antitoxins. In the lower animals the disease is usually intentionally produced by repeated inoculations with what is analogous to a vaccine. The antitoxins contained in the serum are formed by the body cells in their reaction against the effect upon them of the toxins[2] produced by bacteria causing the disease from which the person or animal suffered. Diseases which give rise to antitoxins

[1] The horse is the animal generally used for obtaining sera, because a larger amount of blood can be taken from it without causing lasting harm than from smaller animals.

[2] Space will not permit of going into the details of the nature and formation of antitoxins and vaccines; for further information see a textbook of Materia Medica or Bacteriology.

accustom the cells, it is thought, to form antitoxins, a different kind for each infection, and, thus, one attack of such a disease is likely to protect the individual against further attacks, because, if similar bacteria again invade the body, the toxins they produce will combine with the antitoxins and, as they cannot then unite with the body cells, they will be harmless. If, however, blood containing antitoxins is taken from one individual (or animal) and the serum from it injected into another person the recipient's cells take no part in the production of antitoxins, and those introduced are either eliminated or destroyed in a short time; therefore, the period of immunity given an individual by the injection of an antitoxin serum is generally limited to a few days. Immunity gained by the receipt of an antitoxin is termed *passive immunity*, because, as just stated, the recipient's cells take no part in the production of the antitoxin, while that gained by an attack of a disease is called *active immunity*. In order that it may give immunity, an antitoxin must be administered before the toxin combines with the cells.

Vaccines usually consist of preparations of toxins, or of dead bacteria, or of living organisms the virulence of which has been attenuated by some means.[1] A vaccine introduced into the body has a similar, though very much weaker, effect upon the cells as the toxin produced in an attack of the disease which the vaccine is used to prevent or limit. As the effects of vaccines are less extensive than those of disease, the immunity they afford is not as lasting. The

[1] There are a few vaccines which are not of this nature, notably the pollen vaccine, which is a watery extract of various plants that are thought to be the cause of hay fever.

length of the period of immunity varies with different vaccines.

Vaccines are also used during the course of certain diseases, for the administration of a suitable vaccine at proper intervals will, in some infections, stimulate phagocytosis. Vaccines for this purpose are sometimes prepared from cultures taken from the patient. These are known as *autogenous vaccines.*

The majority of sera and vaccines other than the smallpox virus are given either as intramuscular, intravenous, or subcutaneous injections, but certain sera are introduced into the spinal canal, following lumbar puncture, and others, especially tetanus antitoxin serum, are injected at the site of infection. Those given subcutaneously are not, as a rule, given in the sites mentioned on page 465, because there is usually a considerable amount of serum given at a time, and, therefore, a location is chosen where there is a relatively large amount of loose tissue that is poorly supplied with nerves. Such parts are: below the breasts, about an inch below the center of the clavicle, the posterior portion of the axilla, the upper portion of the abdomen. The syringe is to be sterilized and the skin disinfected in the same manner as for intra-muscular injections, otherwise the procedure for such subcutaneous injections is the same as when small amounts of liquid are used in the sites mentioned on page 465.

Smallpox vaccine is given both by injection and by inoculation, for the latter method two[1] small areas

[1] This is not, as is very generally thought, in case one is not effectual, but because one scar will not supply sufficient toxin. The organisms in the virus remain at the point of inoculation and there form the toxin which is carried through the body by the blood.

of skin (about ¼ inch in diameter) about an inch apart, are scarified (scraped) deeply enough to draw serum, but not blood, and the lymph containing the virus is deposited within the areas and rubbed in with the side of the scarifier, or the tip of a sterile dropper, or other instrument. The lymph is allowed to dry and the part is then covered with a small cap or compress of sterile gauze. In some States, the Board of Health provides sealed tubes containing an ampule of lymph and a scarifier sterilized ready for use, but a sterile needle or scalpel can be used as a scarifier. The operation is generally performed by a doctor and the nurse's usual duties consist in preparing the necessary appliances and the patient's skin. The latter is sometimes disinfected by painting it with iodine, but some doctors consider that the iodine affects the virus and prefer that the preparation consist of washing the skin with (1) soap and water, (2) ether, and (3) alcohol. It is to be remembered that failure in asepsis is likely to result in a serious infection.

Following the use of vaccines there is normally, if the treatment is effectual, a varying degree of malaise, but, ordinarily, the use of an antitoxin or of a normal serum is not followed by any marked discomfort. Some people, however, are very easily influenced by certain kinds of proteins and in such quite a serious condition may sometimes result; this is known as *anaphylaxis* or *serum sickness*. The following are common symptoms of such disturbance: Fever, headache, asthmatic attacks, edema in various parts of the body, urticaria, and, when the condition is severe, collapse. It has been found that many people who are easily affected in this way by sera are also

susceptible to certain food proteins; for example, they may have an outbreak of hives after eating fish or eggs, or they may have attacks of asthma if they eat more than a limited amount of protein food.

Demonstration 86

Aspiration. Paracentesis or Puncture

By aspiration is meant *the removal of fluid from a cavity by means of an aspirator*, i. e., an apparatus, as a syringe or a bottle, such as shown in Fig. 31, in which a vacuum can be created. The operation consists in inserting a hollow needle through the external surface into the cavity and creating a vacuum in the apparatus attached to the needle, whereupon, as the pressure in the cavity is greater than that in the aspirator, the fluid is forced through the needle.

By paracentesis is meant *the surgical puncture of a cavity for the removal of fluid.* Thus, the essential difference between the two operations is that, in the latter, the fluid is expelled through the inserted tube (which is usually a hollow needle or a canula) without the aid of a vacuum. Fluid that has collected in the abdominal cavity or spinal canal can usually be withdrawn in this way because the internal pressure is great enough to overcome the atmospheric pressure within, and on the free end of, the inserted instrument.

As a rule, it is abnormal accumulations of fluid that are removed by these means.

Fluid may accumulate in any of the closed cavities of the body when the blood-vessels of the part become engorged, because such a condition causes excessive transudation of fluid from the capillaries and interferes with the normal absorption of lymph and secre-

tions. Such engorgement may be the result of local inflammatory conditions or it may be due to interference with the circulation by pressure upon veins that receive blood from the part or by disease of the liver, heart, or kidneys. An accumulation of fluid in a cavity will interfere with the functioning of the contained organs and may cause intense pain.

Accumulation of transuded fluid in any of the serous cavities is termed *dropsy*, but special names are applied to the condition in different cavities, *e. g.*, abdominal dropsy is termed *ascites;* liquid in the thoracic cavity is known as *hydrothorax* or, when it is associated with pleurisy, the condition is known as *pleurisy with effusion*, or if the effusion become purulent, *empyema ;* a collection of air in the pleural sac is known as *pneumothorax;* an effusion of liquid within the cranium is termed *hydrocephalus*.

Aspirations and punctures are always performed by the physician and the nurses' principal duties consist in preparing the utensils and patient, giving the doctor the help required, and watching the patient's condition. The last-mentioned duty is very important when a large amount of fluid is removed, for, unless care is taken, fainting, or even a more serious stage of collapse, may occur. Nor is the danger over with the operation, and, therefore, a patient needs careful watching and must be kept very quiet for several hours following it. The principal cause of collapse is the effect produced upon the circulation by the removal of the pressure from around the organs and, as lung tissue will expand more readily than that of other organs, and thus favor a sudden inrush of blood, this is particularly likely to occur during aspiration of the pleural cavity.

Points of special importance to remember in addition to that just mentioned are: That (1) any break in asepsis may cause the sterile serous fluid in the cavities to become purulent; (2) it is downright cruelty to provide needles that are the least bit blunt[1]; (3) for an abdominal puncture the bowels and bladder must be as empty as possible for, if they are distended, there is some danger of their being punctured. For this reason a patient must always void urine just before the operation and as, for anatomical reasons an empty bladder is even more important with women than men, some physicians require the former to be catheterized. Also, it is the rule in some hospitals that an enema be given a short time before this operation. Where there is no such rule, a nurse must ascertain when the patient's bowels moved and, if there is any reason to believe that catharsis is necessary report the fact.

It would be impossible to demonstrate these operations in class, but the utensils required, the positions in which the patient is to be placed for the different ones, the necessary preparations and the reasons for these are to be learned.

Requisites for aspirations: 1. The articles required for disinfecting the skin, see Chapter VII.

2. A local anesthetic, either novocaine or ethyl chlorid are generally used.

3. Two aspirating needles.[2]

[1] To avoid any necessity for doing so (1) never allow the point of a needle to come in contact with anything hard and (2) examine needles before putting them away after use and, if one is blunt, take it to the head nurse or whoever is responsible for making exchanges; do not put away a needle that is unfit for use.

[2] Though only one needle is required, two, of different caliber, are usually prepared.

4. The aspirating apparatus. This when only a small quantity of fluid is to be withdrawn is usually a Luer or similar syringe, but if any considerable quantity of fluid is to be taken it is either a bottle, in which a vacuum can be created by means of a pump, with the cork tubing and pump, as shown in Fig. 31, or else a piece of tubing about one quarter of an inch in diameter and eighteen inches long, in one end of which is a metal piece that will allow of the tubing being attached to the aspirating needle and a large-sized glass syringe with a long, blunt point that will fit securely into the tubing.

5. A utensil to receive the extracted fluid. This, when a syringe is used is generally a sterile test-tube plugged with sterile cotton[1] and, when a large amount of liquid is to be extracted a sterile bottle, the mouth of which is kept plugged with sterile cotton until the bottle is needed,[2] or, if the so-called *vacuum bottle* is used it will answer the purpose.

6. About three sterile sponges.

7. Two sterile towels other than those used to cover the tray on which the sterile utensils are to be placed, as described in Chapter VII.

8. A sterile basin containing sterile water with which to test the aspirating apparatus.

[1] One or other of the appliances last mentioned is nearly always used for aspiration of the pleural cavity, except when the aspiration is performed merely to see if there is fluid in the cavity or to obtain a small amount of fluid that is known to be there for examination. When the aspiration is performed for these purposes it is commonly called an *exploration*.

[2] As a rule the utensil is to be kept sterile inside as well as out, to avoid contamination of the fluid for this is usually examined for diagnostic purposes and it is sometimes used as a basis for certain culture media.

9. Two pair of sterile gloves.

10. A pair of sterile forceps with which to handle the needle and dressing.

11. A surgical dressing. This usually calls for either collodion and a sterile swab or a small, sterile gauze compress and two strips of adhesive plaster about five inches in length and two in width.

12. A receptacle for soiled sponges, etc.

13. A shoulder wrap.

14. Stimulants if ordered.

For the aspiration of a vein, there will be needed in addition a rubber bandage, or a piece of rubber tubing and an artery clamp, to be used as described under an intravenous injection, in the preceding demonstration, and a gauze bandage for the dressing. The shoulder wrap will not be required.

Requisites for a lumbar puncture: The same as for an aspiration. Ordinarily, an aspirator is not used (if one is, the treatment becomes an aspiration) but a syringe to fit the needle is generally provided, as occasionally, one is required.

Requisites for an abdominal paracentesis: 1. Articles required for disinfecting the skin.

2. A canula and trocar.

3. Rubber tubing about one and a half yards long, which is attached to the projection of the canula that is not blocked by the trocar.

4. Scalpel.

5. Probe.

6. Scissors.

7. Two suture needles

8. Artery clamp.[1]

[1] This, it will be noted, is rarely used, but it should always be provided in case of hemorrhage.

9. Forceps.

10. Local anesthetic, either novocaine or ethyl chlorid are generally used.

11. Two large sterile bottles which are kept plugged with sterile cotton until required.[1]

12. A small package of (or about twelve) sterile sponges.

13. Suture silk.

14. Two sterile towels other than those used for the tray on which the sterile articles are placed.

15. A sterile dressing consisting of two large pieces of sterile gauze and two pieces of absorbent cotton.

16. Adhesive plaster.

17. Two binders one of which must be sterile and a scultetus.

18. Four sterile safety pins.

19. Two dressing rubbers.

20. Two blankets, only one will be required if the patient is not able to sit up in bed.

21. A board about two feet wide, to put across the bed under the springs to prevent the latter sagging.

22. Laparotomy stockings.

23. If the patient sits up in bed, a back rest, or else about six extra pillows, and a bandage or heavy twine; if the patient is to lie down during the operation, only three extra pillows will be needed.

24. Two stools for the patient to rest her feet on; these will not be needed if the patient does not sit up.

25. Stimulants if ordered.

Requisites for the puncture of a vein (commonly known as *phlebotomy*):

[1] If it is not necessary to keep the fluid sterile a pail can be used. See footnote, page 490.

1. Tray with articles required for disinfecting the skin.
2. Scalpel.
3. Aneurism needle.
4. Two artery clamps.
5. Probe.
6. Scissors.
7. Sterile graduated glass pint measure to receive the blood.
8. Suture needles.
9. Catgut.
10. Suture silk.
11. Sterile rubber bandage or piece of tubing and artery clamp.
12. Two sterile towels.
13. Sterile sponges.
14. A basin of sterile salt solution or water, to wash the blood from the arm before putting on the dressing.
15. A bandage.
16. Dressing rubber.
17. Receptacle for soiled sponges, etc.

All the articles except the two last mentioned are to be sterile.

Preparation of apparatus: The only preparation that has not been described in either Chapter I or Chapter VII is the testing of the apparatus for aspiration. This is most important and should be done after the articles have been sterilized because they get out of order easily. The needles need not be tested after sterilization, for, if the wires are in them, their lumen must be free, but they should be examined before they are sterilized.

To test the syringe, when this is the appliance used, draw some of the sterile water into it and then expel

it. If the syringe is in order the piston will move easily, but will not be loose, and the water will come up as far as the piston is pulled back.

When the vacuum bottle is the appliance used, put the cork in the bottle and attach the tubing to the metal projections in the cork. Put the projection of the pump on which the arrow[1] points upward into one of the pieces of tubing, open the stop-cock in the metal piece of the cork above the tubing to which the pump is attached and close the one on the other side. Exhaust the air in the bottle by pumping until the pump grows hard to work (while doing this hold the pump so that the air forced from it will not go over the sterile articles, for it is not sterile, and do not put the pump down where it will come in contact with the needles, dressing, or sponges[2]), close the open stop-cock and open the other one. If the apparatus is in working order the water will flow from the basin into the bottle.[3] Empty the water from the bottle into the basin, change the order of the stop-cocks, once more exhaust the air in the bottle and close the open stop-cock. Leave the basin of water on the tray as the doctor may want the apparatus tested again before he attaches the tubing to the needle. This is usually done by the nurse while the doctor is introducing the needle.

If the tubing and syringe are to be used as an aspira-

[1] The majority of exhaust pumps used for this purpose have two projections, on each of which there is an arrow which points in the direction that the air will go as it is forced from the bottle.

[2] Exhaust pumps cannot, as a rule, be properly sterilized or disinfected because if liquid enters the valves the washers shrink and then the pump does not work properly.

[3] This is the end that will be attached to the needle during the operation.

tor, attach them, putting the nozzle of the syringe into the end of the tubing that has no metal piece, put the free end of the tubing in the basin of water and draw back the piston of the syringe; if the syringe is in order and the lumen of the tubing clear, the water will be readily forced through the tubing into the syringe. Disconnect the syringe and tubing, for, as a rule, they are not wanted connected until after the needle has been inserted.[1]

Preparation of Patient for Aspirations and Punctures

Necessary Disinfection: The skin at and surrounding the area in which the puncture is to be made is shaved if necessary and then washed with soap and hot water and, following this, with first alcohol and then ether. If this is done such a short time before the operation that the skin would not be dry enough to allow of iodine being effectual, a compress wet with alcohol or other disinfectant is placed over the area. If, however, it is finished earlier nothing further is done until the physician is nearly ready and the patient is in position when the area is painted with iodine 3%. When shaving is not necessary the preliminary washing is often omitted.

For aspiration of the pleural cavity the needle is inserted between the ribs either in the back below the angle of the scapula or on the side between the eighth and ninth, or the seventh and eighth ribs. As the point of insertion varies somewhat, unless

[1] If it is not in order the trouble must be rectified or the apparatus cannot be used. The most common trouble is that the lumen of the metal piece or tubing has become blocked by material left as the result of imperfect cleansing after previous use.

definite directions are given regarding the area of skin to be prepared, it is usual to include the space from within an inch of the spine (on the affected side) to about an inch beyond the axilla and from the lower end of the scapula to about an inch above the waist line. The operator may want the patient to be placed in either a sitting or a semi-recumbent position. If the former, when the doctor is nearly ready, have the patient sit up near the side of the bed on which the operator will stand, remove the nightgown from the arm of the affected side and arrange it so that it will be out of the way, but over the other side of the chest and back, and, if necessary, cover this side also with a shoulder wrap. Have the patient lean forward and place the hand on her affected side on her opposite shoulder. This position increases the width of the intercostal spaces. If the patient is to be in the semi-recumbent position, draw her to the side of the bed and place her on her side, leaning considerably forward, if the puncture is to be made in the back. Arrange the pillows so that her head and shoulders will be higher than the point of puncture[1] and have her shoulders bent forward, as when she was sitting up, and her hand of the affected side resting on her opposite shoulder or on a pillow placed on a level with the latter. Disinfect the skin, as already described and surround the area with sterile towels.

[1] It will be noticed that the puncture is always made near the lowest level of the cavity from which fluid is to be extracted. This is because the liquid gravitates to the floor of a sac. A sitting position naturally favors this and, thus, it is sometimes preferred, but the recumbent position is much less trying to the patient.

For aspiration of the pericardial sac, the needle is usually inserted between the fourth and fifth or the fifth and sixth ribs close to the margin of the sternum on the left side and the skin is to be disinfected from the median line to about two inches beyond the margin of the sternum and from the third to the seventh rib. The patient either lies on her back with a pillow under her head and shoulders or is propped in a sitting position.

The aspiration of a vein is usually performed to obtain a specimen of blood for examination. One of the veins in the bend of the elbow of the left arm is usually chosen and both the preparation of the patient and the operation are similar to an intravenous injection, the differences being that, instead of having a liquid in the syringe, the piston is inside and, after the needle has been introduced into the vessels, the piston is drawn backward and blood thus aspirated.

For the withdrawal of fluid from the spinal canal (lumbar puncture) a needle, such as is used for aspirations, is inserted between the fourth and fifth lumbar vertebræ (it is because of the location of the puncture that the operation is known as *lumbar puncture*), and the skin is to be disinfected for about two inches on all sides of this point. In order to facilitate the insertion of the needle, the laminæ of the vertebra must be separated and to do this the back must be curved, therefore, if the patient is to lie down,[1] place her at the edge of the bed or a table with her knees

[1] This position is nearly always used for a child, as its movements can be more easily controlled than when it is sitting up, and for a patient whose condition is poor, but, as an upright position greatly facilitates the flow of fluid, it is generally used when possible.

drawn up toward her chest and her shoulders bent forward. If the patient is to sit up, place a bed table across the bed, put a pillow on it, and have the patient lean forward and rest her arms on this. Arrange the patient's nightgown so that her back, but not her chest, will be exposed; place a folded dressing towel on the bed just below the point of puncture.

For abdominal paracentesis the puncture is usually made in the linea alba, midway between the umbilicus and the pubes and, unless other directions are given, the area of the skin prepared includes two or three inches on either side of the central line from an inch or two below the umbilicus to just above the pubes. Except in the case of children shaving is usually necessary and the method of preparation very commonly used is as described on page 486. As stated on page 480, catharsis has to be considered and the patient is to void urine just before being placed in position.

When possible the operation is done with the patient sitting on the edge of the bed with her legs over the side. To arrange the patient in this position, put on her laparotomy stockings, draw her to the edge of the bed, have her sit up with her legs over the side and, if necessary move her so that she will be near enough the head of the bed to lean against it if she wishes to do so. Place stools for her feet. Put a blanket around her legs and one around her body, pin back the lower ends of the latter so that her abdomen will be exposed. Put a back rest[1]

[1] If a suitable rest cannot be obtained, pile five or six pillows one on top of the other, tie a bandage or cord around them; on each side, to hold the pile together, and then tie the free ends of the strings to the bar at the side of the bed on which the patient is sitting.

behind her and secure this in place; this can be done by tying a piece of strong bandage or cord through the lower bar of the rest on each side, bringing these strings forward and tying them to the bar on the side of the bed on which the patient is sitting. Put a dressing rubber over the blanket, bare the abdomen.

A nurse, who, in the meantime, has disinfected her hands, should paint the required area with iodine. Place a sterile towel over the rubber, and pin another around the blanket (using sterile safety pins), above the abdomen. Put the sterile scultetus binder[1] around the loins and, in order that the front of this may be kept sterile roll a sterile towel around the end that must be passed behind the patient; pin with sterile safety pins two or more of the tails of the binder in the front, but toward one side, leaving an exposed space of about five inches at the area for the puncture. Remove the plug from one of the bottles and place the plug on the sterile towel (it will be needed again if the fluid is to be saved as is usually the case when sterile bottles are used), and the bottle where the rubber tubing that is attached to the canula can be put into it as soon as the canula is inserted in the puncture, and the sterile nurse usually does this as the doctor is manipulating the canula.[2]

If the patient is unable to sit up, draw her over to the side of the bed, put a dressing rubber covered with a towel under her, turn her on her side, place pillows

[1] The purpose of this binder is to hold the abdomen forward and thus prevent pocketing of the fluid and it is to be tightened during the operation when the shrinking of the abdomen following the loss of fluid causes it to become loose.

[2] If the fluid is not to be saved a pail is generally used and the unsterile nurse puts this in place. It is generally stood on the floor or a stool near the patient's feet.

against her back, turn the bed covers down below the abdomen, put a small blanket or nightingale across her chest, put a dressing rubber over the covers at their contact with the abdomen. The nurse who has disinfected her hands then performs the same duties as when the patient is sitting up.

The operation consists in making a small incision with the scalpel, inserting the trocar and canula into the wound and withdrawing the trocar, whereupon, the liquid in the cavity flows through the canula and tubing into the receptacle provided for it. After the operator removes the canula a piece of sterile gauze is put over the wound and the patient is to be made comfortable in bed, then the rest of the dressing, which usually consists of two or three gauze compresses and pieces of cotton, is strapped in place with adhesive plaster and an abdominal binder is put on and pinned as tightly as the patient can stand it. The dressing must be watched and changed when necessary as there is likely to be considerable oozing.

Phlebotomy or venesection, is the puncture of a vein for the withdrawal of blood. It is performed to relieve an excessively high blood-pressure and to remove toxic blood from the body—as in gas and uremic poisoning. In the latter case the phlebotomy is usually followed by an intravenous infusion.

The operation consists in making a puncture in one side of a vein with, usually, a scalpel and allowing blood to flow into a sterile graduated measure. When the amount required has been withdrawn the wound is sutured and a sterile dressing applied. The vein chosen is usually one of those in the inner bend of the elbow and the preparation required is the same as for an intravenous injection.

The nurse's principal duty when assisting with any of these treatments is to care for the patient. She must, for the reasons given on page 479, watch for symptoms of faintness and be ready to restrain the patient's movements if necessary; a child usually has to be held and, if it is conscious, means taken to divert his attention throughout the operation. When the necessary utensils are in order the operator seldom asks for assistance if the nurse is busy with the patient. That generally given by a nurse who is at liberty and has sterile hands is to (1) hold or place the receptacle for the reception of the fluid taken from the cavity: (2) during an abdominal paracentesis tighten the binder as it becomes loosened; (3) apply the dressing at the conclusion of the treatment.

What is to be done with the receptacle for the fluid depends upon the apparatus used and the position of the patient. If the vacuum bottle is used it is left on the tray or table and, after the nurse has pumped the air from it as already described in preparation for the treatment, there should be nothing further for her to do about it; if tubing, attached to the needle, and a syringe are substituted for the vacuum bottle, after the doctor introduces the needle into the cavity he inserts the syringe in the free end of the tubing, draws back the piston until the liquid appears in the syringe and, if possible, the nurse then removes the plug from the bottle and holds the latter under the connection of the tubing and syringe, whereupon the doctor removes the latter and puts the end of the tubing and the contents of the syringe into the bottle. If the patient is sitting up the bottle is usually placed beside her on the bed or on the table, but if she is lying down it is usually necessary to put it lower,

because it must be far enough below the needle for the attached tubing to hang perfectly straight, and it may be placed on a stool or tied to the bar at the side of the bed. If all the fluid withdrawn is taken into a syringe, the nurse, at the conclusion of the operation, may be expected to remove the plug from a test tube, hold the latter while the doctor forces the fluid into it from the syringe and reinsert the plug. If the fluid is to flow directly from a needle or canula into the receptacle (as is usual in lumbar puncture) the latter is held just below the exit of the former.

To remove a sterile plug from a tube if it is to be reinserted at once take the latter in your left hand, take the upper part of the plug between two of the fingers of your right hand in such a manner that the portion which fits into the tube will project from behind your fingers and not touch your hand or anything else, pull it out and hold it thus. When replacing it be careful not to let it touch anything. When the plug is not to be reinserted at once, take it out in the usual manner, place it on the sterile towel covering the tray and put a corner or fold of the towel over it so that nothing unsterile will come in contact with the part that is to be reinserted. Of course, these precautions are only necessary when the fluid is to be sent to the laboratory.

The dressing, when the wound has been made with a needle, usually consists of an application of collodion[1] and a gauze compress strapped on with adhesive plaster, except when the wound is on an arm, when the collodion is omitted and the compress is bandaged

[1] The collodion is used because, unless a bandage or binder is put on, the compress does not stay in place well.

in place. The dressing used after abdominal paracentesis has been already described.

Leeches

In the past leeches were much used to extract blood both for the relief of systemic conditions associated with high blood-pressure and to lessen local congestion. They are, however, rarely used at the present time, phlebotomy or aspiration of a vein being substituted for the former purpose and bleeding for the relief of local congestion is a form of treatment but little employed at present and, when it is, the usual method is to make a small incision in the skin and apply a Bier's cup. The modern methods have at least four advantages, viz., they are more aseptic, they are less repellent to the patient, the amount of blood taken can be better estimated and controlled; there is, ordinarily, no danger of hemorrhage following them and there is after the use of leeches because the latter secrete a ferment that lessens the coagulable property of the blood and inject it into the tissues of the part to which they are applied. The application of leeches can hardly be shown in class and the majority of pupils during their entire training will not see them used but the procedure is simple and they should be able to put the following instruction into practice if occasion arises. The most common use of leeches at the present time is for the relief of congestion around the eye and ear when small Bier's cups cannot be obtained. One or more may be used at a time, the doctor specifies the number.

Leeches are kept in a jar containing water and sand and supplied with a perforated cover—the

latter must be kept on or the leeches may crawl out. About an hour[1] before they are to be put on take the leeches needed from the water and place them in test tubes or small bottles. Tie gauze over the openings to prevent the escape of the leeches (corks should not be used as the leeches need air).

Cleanse the patient's skin as when an incision is to be made and disinfect it with bichlorid or other odorless disinfectant.[2] Just before applying the leeches smear the skin with some sterile sugar solution using a sterile sponge. The leeches will bite more readily if this is done.

To apply a leech, see that its head[3] is toward the opening of the tube, take off the cover, and hold the tube tilted on the part where the leech is wanted attached. If necessary, shake the tube a little to make the leech come out, but disturb it as little as possible. Never place a leech over a visible vein nor in a part where pressure cannot be made against a bone if there is hemorrhage; if one is put near an ear put a piece of cotton in the latter for occasionally a leech will wander from the part to which it is applied. Never attempt to pull a leech off once it has taken hold, or it may leave its sucker in the wound and thus cause a serious inflammation. If it is to be removed before it lets go put a little salt on its tail; this will make it fall off. If left undisturbed, a leech will drop off after it has taken as much blood as it can. After use, put all the leeches in an empty

[1] This is because they will usually take hold more readily if they have been deprived of water and food for some time.

[2] The leeches will not bite the skin if there is an odor to it.

[3] The head is a little bit less pointed than the tail and there are two minute projections at the mouth.

paper bag or bottle and kill them by covering them with salt.

After the leeches are off, if they have taken sufficient blood, paint the part with iodine (3%) and apply a sterile gauze dressing. When enough blood is not withdrawn, the doctor sometimes orders the application of hot compresses as these will encourage bleeding, but this should not be done without an order as it increases the possibility of hemorrhage. Should hemorrhage occur, make firm pressure over the part and, if possible, inject a little adrenaline into the wound.

CHAPTER XVI

Demonstration 87

Intubation. Tracheotomy. Artificial Respiration.

Intubation is the introduction of a firm tube into the larynx through the glottis to prevent asphyxia from obstruction in or above the larynx. Tracheotomy is the introduction of a tube into the trachea through an incision in its anterior wall. This operation is performed when there is an obstruction below a point that will be reached by an intubation tube. Artificial respiration is used when an individual cannot breathe naturally. It may be performed with the aid of an appliance known as a pulmotor or a lungmotor or without any apparatus. The pulmotor is of great assistance, however, especially when the respiration has to be maintained for a long time as is sometimes the case, especially in the treatment of opium poisoning.

Requisites for intubation: 1. An intubation set,[1] which consists of a mouth gag; tubes of different sizes; obturators, which are the removable pieces of metal in the tubes into which the introducer fits; heavy

[1] The intubation appliances were invented by the late Dr. O'Dwyer of New York and are therefore commonly known as the O'Dwyer Intubation Instruments.

thread, a loop of which should be in the hole that is in the rim of each tube; an introducer; an extractor.

2. A gauze compress.
3. A towel.
4. A sputum cup.
5. Scissors.
6. Adhesive plaster.
7. A small pillow.
8. A sheet.
9. A light and head mirror will be required unless the room is well lighted.

Requisites for demonstrating the cleaning of the tubes in the care of a patient after tracheotomy:

1. A tracheotomy tube.
2. Two pieces of tape about twenty-four inches long.
3. A curved probe.
4. A pair of forceps.
5. Two small dressing basins containing sterile water.
6. Small (about three inches) squares of sterile gauze.
7. A bag or other receptacle for soiled gauze.
8. A sand bag or suitable substitute.

Requisites for artificial respiration: 1. A pulmotor or lungmotor. 2. A watch or clock.

Intubation

This procedure cannot of course be demonstrated in class, but the pupils should inspect the apparatus and understand the use of the different articles and memorize the instruction given so that any one of them will be ready to give a doctor efficient aid if

called upon and be able to understand his instruction if he shows her how to perform the operation in his absence, which is sometimes necessary, for the tube occasionally comes out when the patient coughs.

Procedure: Choose a tube the required size. Those intended for children are numbered and the one with the number nearest the child's age is usually the most suitable. Connect the introducer with the obturator in the tube. Arrange the light in position as described for examination of the throat in Chapter VII. Place the patient in position. An adult is usually wanted in the dorsal recumbent position on a table or at the side of the bed. Put a small pillow or suitable substitute under the neck so as to throw the head slightly backward and thus extend the throat, otherwise the head must be perfectly straight. A child is sometimes wanted in the same position, but many physicians prefer to have the nurse hold a small child in her lap. For either of these positions, the child, unless it is old enough not to resist, is to be wrapped in a sheet as described in Chapter VII. If the child is to be held one nurse sits with it in her lap and holds its legs between hers, as in Fig. 28, and puts her arms across the child's arms and chest. Another nurse stands behind the child and grasps its head firmly, holding her thumbs on top of the head and her fingers under and at the side of the chin, and draws the child's head upward as far as possible, keeping it in a perfectly straight line.

While inserting the tube, the operator sits facing the patient. After putting in the mouth gag, if this is necessary, he introduces the index finger of his left hand into the mouth and, with it, holds the tongue down and the epiglottis forward. After seeing that

the thread loop is free, he passes the tube and connected introducer into the mouth, alongside of his finger, slips the tube into the trachea, presses it into position with the finger of his left hand, and then, immediately, removes the obturator from the tube by pulling upon it with the introducer to which it is attached.

One nurse is to be ready to hold the sputum cup to receive the discharge of mucus, etc., that is generally forced up as the air comes through the tube.

If the tube is in the trachea, as soon as the coughing and expectoration that its introduction usually excites are lessened, the patient's breathing and color will be improved. If, as sometimes happens, the tube has been inserted in the esophagus, no improvement will take place. It is to prevent the tube being swallowed should it be so misplaced that the thread is attached to it and, if the tube is in the esophagus, it is pulled out by making traction on the string.

The loop of thread is sometimes left attached to the tube as long as the latter remains in place but, as a rule, it is removed as soon as the tube is in place and, when the tube is no longer necessary, it is removed by means of the extractor. If the thread is to be removed, cut off the knot, for, if the loop is cut, but the knot left on, the knot may be drawn to the hole in the tube and cause the tube to be displaced. If the thread is left on, put the loop over the patient's ear and a strip of adhesive plaster over the thread across the cheek. An objection to leaving the thread is that a child is likely to pull it and thus drag the tube out of place.

The method of feeding a patient after intubation has to be considered for the presence of the hard tube

in the trachea interferes somewhat with the normal movements associated with swallowing; also, it is much easier for material to enter the firm hole of the tube than the more pliant trachea. Thus liquid or semi-liquid food is given, and it has been found that, as a rule, if the head is lowered backward, the passage of food is facilitated. For this reason, it is customary to put a pillow under the shoulders of an adult or large child, allowing the head to extend beyond it and slightly backward, and if the patient is a small child, to either place it on a table, with its head extending beyond it and supported at a lower level, or to hold it on the lap with its neck at the edge and the head falling slightly backward.

Tracheotomy[1]

Except in extreme emergency tracheotomy is performed in the operating room, but if necessary to prepare for it in emergency get, in addition to the articles mentioned on page 498, a small, sharp scalpel, two or three artery clamps, scissors, forceps, two small retractors, catgut, sponges, gauze dressing, dressing towels, articles for disinfecting the skin, local anesthetic, sand bag; with the exception of the bag, everything, including the tubes, must, of course, be sterile.

The patient is placed in the recumbent position with the sand bag under the neck and the head falling

[1] The only procedure that can be demonstrated in this connection, that has not already been taught, is the care of the tubes. It is, however, very essential to understand how to connect and disconnect and wash the tubes, as it is often necessary to do so very speedily.

backward, so as to make as much space as possible between the cartilages, the skin is disinfected, and the area surrounded by towels as described in Chapter VII. The operator makes an incision into the trachea, introduces the tubes, one inside the other, and puts a piece of sterile gauze between the wound and the plate of the outer tube. In the rim of the larger tube there is a slit on each side through which a piece of tape is put and these are tied around the neck to hold the tube in place. There is also a clamp on the top of this tube and a groove on the top of the smaller one into which the clamp fits when the small tube is inside the larger one. The reason for the double tube is that, for some time following the operation, discharge is likely to block the tubes frequently and the easiest way to rectify this is to remove the inner one, wash, dry, and replace it. This prevents the necessity for any exposure of the wound. To wash the tube put it into one of the basins of water, wind a piece of gauze around the curved probe, and move this around inside the tube.

A piece of moistened gauze is kept over the opening of the tubes or else the air is kept moist by the use of a steam kettle as described in Chapter XIII., because air entering the trachea through the tube is not moistened, as it is in passing through the nose and pharynx, and dry air is likely to irritate the larynx and provoke coughing.

The basins containing the water for these purposes, the gauze, probe, and receptacle for soiled gauze should be kept on a tray and covered with a sterilized towel. The water for washing the tube must be changed as often as it is soiled, that for moistening the gauze, three or four times a day.

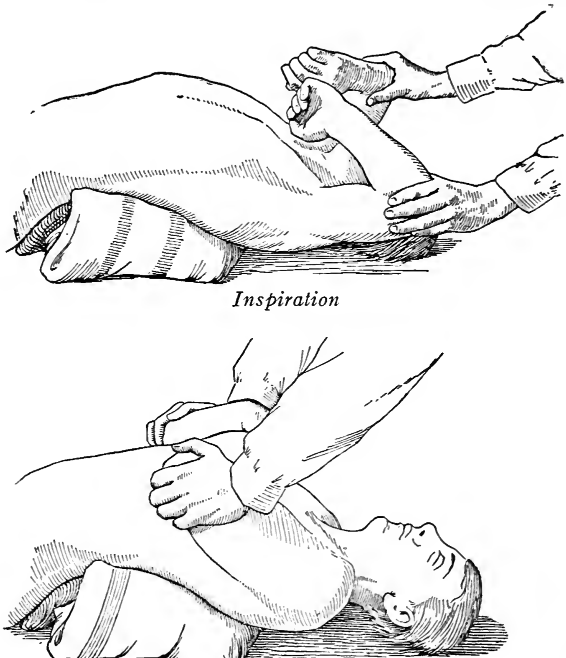
Artificial Respiration

Artificial respiration, as previously stated, may be given with a pulmotor or lungmotor or without any apparatus. The method of using a motor is so dependent upon the type of machine and there are so many varieties that it hardly seems advisable to attempt to describe the details of procedure, especially as, where there is a pulmotor to be had, there is usually a doctor, and printed directions for the use of a machine are generally to be found in its container. There are, however, certain points to be remembered when giving artificial respiration either with or without a machine; viz., the movements are to be slow and even, without jerking or violence, but they must be forceful. Evenness of motion is particularly essential when a lungmotor is used in which a tube is inserted in the trachea and the air pumped directly into the lungs. Another precaution in the use of such a machine is that the opening (present on the tube in the majority of types) for the egress of air from the lungs is to be closed when air is being pumped into the lungs and opened when the pressure on the pump or bellows is released, *i. e.*, in expiration.

The methods of artificial respiration most commonly used without a machine are those known as the *Sylvester* and the *Schaefer* methods and the pupils should be shown how and practice giving artificial respirations in these ways on each other, for it is most important that nurses should be able to carry out these methods properly, since in poisoning by a number of drugs, and other emergencies, breathing ceases before the heart action and if forced breathing can be maintained until the respiratory

center assumes control, the person's life may be saved.

The Schaefer method is easier to perform and generally considered a better method than the Sylvester, especially when resuscitating a person after drowning,



Inspiration

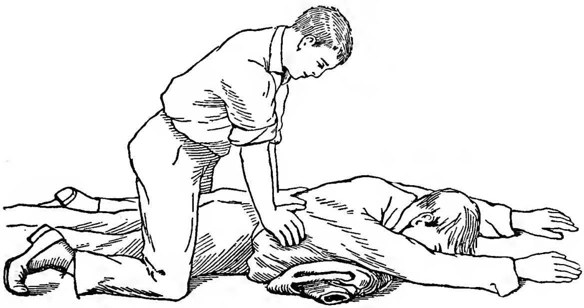
Expiration

Fig. 48. Sylvester method of artificial respiration.

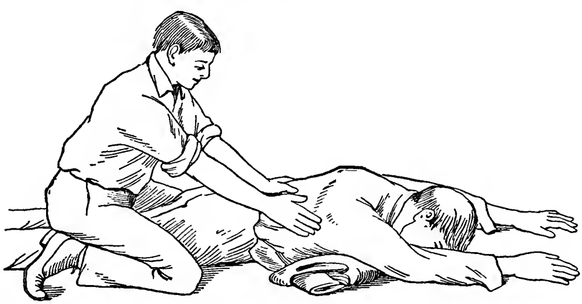
but it is not always applicable in the emergencies that occur in the care of the sick.

The Sylvester method is as follows: Place the patient on her back, with a pillow or a substitute under it at about the waist line, so as to raise the lower part of the

chest; there should be no pillow under the head. Stand or kneel at the patient's head, grasp the arms about the elbow, and draw them away from the body and upward as far as they can be extended. Hold



Pressure on expiration



Pressure off inspiration

Fig. 49. Schaefer method of artificial respiration.

them stretched in this position for about three seconds (these actions elevate the ribs and expand the chest in somewhat the same manner as inspiration); then slowly lower the arms until the chest is reached and press the elbows slowly and firmly against it on the lower ribs, so as to force air from the chest, *i. e.*, expira-

tion. These movements should be repeated at such a rate that sixteen (counting the two processes as one) will be made per minute.

If the patient is heavy, it may require two persons to give the treatment and in such case stand one on either side, near the patient's head, and proceed as already described, being careful to work in unison.

With this method it is always necessary to watch that the patient's tongue does not fall backward over the larynx.

Schaefer method: Lay the patient prone on the ground with a pillow or substitute under the lower part of the chest, the head turned to one side, and the arms stretched above it. Kneel across the patient's thighs, facing the head. Place your hands flat over the lower part of the back, on the lower ribs, your fingers pointing toward the sides; lean forward so as to throw the weight of your body upon your hands and thus make all the pressure possible upon the patient's chest; do this gradually and slowly (this movement, which is a substitute for expiration, will force air and, if it is present, water from the lungs); then, as gradually, relax the pressure by slowly straightening your back, but keep your hands in position. Repeat these movements of pressure and relaxation at a rate that will allow of about sixteen (the two movements being counted as one) per minute.

Artificial respiration should be continued until natural respirations are resumed or all hope of resuscitating the patient has been abandoned.

CHAPTER XVII

Wounds

The classification, means of repair, and common complications of wounds. Methods of dressing wounds. The Carrel-Dakin treatment of wounds.

A wound is usually defined as *any solution or break in the continuity of body tissue caused by violence or intentional cutting.*

According to their nature wounds are classified as:

1. Incised wounds, *i.e.*, those in which the edges are clean cut and there is no tearing of the tissues. Such wounds are made with a sharp instrument as a knife.

2. Contused wounds, *i. e.*, those associated with contusion[1] or bruising of the tissues. The edges of such wounds are usually crushed and jagged. A wound of this kind is generally made by a blow from a heavy object or a fall.

3. Lacerated wounds; in these the edges are torn and mangled. These are the kind of wounds likely to be produced in accidents caused by machinery.

4. Punctured wounds; in these the wound is deep in proportion to its diameter and it has but a small opening. Such wounds are produced by pointed

[1] A contusion is a wound, associated with rupture of blood-vessels, beneath the skin. The discoloration is due to the extravasation of blood into the tissues.

objects as nails, daggers, etc., and, sometimes, by bullets.

Wounds are also classified according to their origin (*e. g., operative wounds, gunshot wounds*, etc.) and depending upon their freedom from, or contamination with, bacteria, as *asceptic and infected wounds.*

Aseptic wounds are defined as *wounds which are sufficiently free from microörganisms to show no symptoms of infection*, and **infected wounds** as *wounds which are invaded by organisms sufficient in number and virulence to produce pathological symptoms.*

Allied to wounds, though not usually classified as such, are the open sores such as ulcers, pressure sores, etc.

Healing of Wounds

Four processes by which the body endeavors to repair wounds in its tissues are: The inhibition of infection; the disintegration and removal of debris such as blood clots and devitiated cells; the proliferation of new cells to replace those destroyed; and, when possible, the sealing together of the walls of the wound.

The primary factors upon which these processes depend result from the injury. They are: the stimulation of the reproductive faculty of the cells and the depression of the vasoconstrictor nerves in the wounded area. As the result of the depression of the vasoconstrictors, the blood-vessels in the part dilate; this interferes somewhat with the rate of the blood flow in the area and promotes congestion and, consequently, transudation of blood plasma and the passage of white corpuscles into the surrounding tissues. These conditions inhibit infection because the escaping

blood washes out the wound and its white cells demolish bacteria, small blood clots, and other debris and promote the liquefaction of clots, and dead tissue, which is a necessary preliminary for the absorption of such matter or, if suppuration occurs, its discharge from the wound in what is known as pus. This will be further described under infection.

The exudate from the vessels, because of its glutinous nature, is also of great importance in the agglutination of the walls of the wound when they are brought into juxtaposition shortly after the injury is sustained.

The process of healing is similar in all kinds of wounds, the difference being in the amount of new tissue required. New tissue is produced in the same manner as tissue arises originally, viz., by cell proliferation; there is, however, considerable variation in the degree of restoration that the cells of different tissues are capable of and parts particularly lacking in this faculty are nerve cell-bodies and muscle tissue. If a nerve is cut, the peripheral portion will die but, if the cell-bodies of its fibers remain intact, the fibers, under favorable conditions, will grow and replace the lost portion, but this growth is slow. If nerve cell-bodies[1] are destroyed they are not replaced. Also, there is little replacement of muscle tissue but the cells of the connective tissue which, it will be remembered, permeates all muscle, as well as other parts of the body, proliferate readily as do also those of the skin and blood-vessels. The cells from the blood-vessels form small loops of capillaries which project from the parent vessels and thus the new connective tissue and epithelial cells are provided with nourishment as they grow out from the

[1] In what portion of the nervous system are the cell bodies contained?

walls of the wound. Chiefly because of the manner in which the new capillaries form, an open wound assumes a rough granular appearance and, for this reason, the new tissue is spoken of as *granulating tissue* or *granulations*.

At first, the new connective tissue cells are soft and oval-shaped, but they gradually contract and harden to a varying degree and the contraction, by the pressure it produces on the newly formed capillaries, causes their obliteration; thus, the new tissue becomes more or less dense, inelastic, and anemic and is known as *scar* or *cicatricial tissue*.

The amount and density of scar tissue and the rate of wound repair will depend chiefly upon the following factors:

1. The nature of the wound. Naturally, an aseptic, incised wound will heal more rapidly than one in which the edges are torn or contused or in which the tissue is disintegrated by suppurative processes.

2. How soon the walls of the wound are brought into apposition. Immediately following injury the conditions are more favorable for agglutination than later, and the more firmly the walls adhere, the less the amount of new tissue required.

3. The age of the individual. In youth, while tissue growth is still in progress, a wound will, other conditions being equal, heal more rapidly than in adult life and there is always a chance of the reproduction of some muscle cells and of the connective tissue remaining relatively pliable.

4. The vitality of the part. Healing occurs but slowly when the area surrounding the wound is devitalized by bruising, or the circulation in the part is

interfered with in any way, and when the individual is the victim of a condition that interferes with nutrition, *e.g.*, diabetes, anemia, arteriosclerosis.

The after effects of an injury are largely determined by the amount of new tissue that has to be formed, for, it can be readily appreciated, if much of the soft, contractile, elastic muscle tissue is replaced by dense, inelastic fibrous tissue, the functioning of the part is likely to be seriously interfered with.

When a wound heals without infection or suppuration it is said to heal *by first intention* or *by primary union*, or *per primum*, or *by apposition*.

Healing by primary intention: If the sides of a clean wound are brought together shortly after they have been severed, agglutination will occur and there will be very little new tissue required so that by about the fourth day after the wound was made the preliminary stages of healing will be completed, though the new tissue will be soft and easily torn, but by the end of from ten to twenty-one days according to the size of the wound and other factors just mentioned, the tissue should, normally, be relatively strong. The new skin along the line of incision, *i.e.*, the scar, will be red for some time longer but the skin surrounding it should be of normal color. Later, due to the contraction of cells already referred to, which drives much of the blood from the new tissue, the scar fades until it is whiter than the surrounding tissue.

Causes of pain: Usually, a few hours after a clean incised wound is sutured pain ceases if the part is kept at rest and the dressing has been properly applied, for pain in a wound is due to stimulation of nerve endings, and in a clean-cut wound, this stimulation soon ceases if conditions are normal. If pain does occur it is

nearly always due either to muscular movement which pulls upon the sutures, or to tension due to too tight splints or bandages or the collection of exudates in the wound, or to infection.

Causes of rise of temperature: Shortly after an extensive wound has been made either intentionally or by accident, there may be a slight rise of temperature, but, unless there are complications, this will subside in a few hours; such a rise of temperature is usually referred to as *traumatic fever* and it is not considered of any importance. If, however, the temperature rises three or four days later, infection is suspected.

Healing by granulation: When for any reason a wound cannot be closed and in injuries, such as burns and deep ulcerations of any kind, in which there is destruction of the superficial tissues the denuded space must be filled in with new tissue as already described and, because of the rough granular appearance which this tissue assumes during growth, healing is said to take place *by granulation* or, as it does not occur as quickly as it does when the wound is closed, *by second intention.*

The small elevations on the surface of a wound which cause its granular appearance consist of the capillary sprouts surrounded by the new connective tissue cells. The cells of the individual granulations elongate and come into apposition with the cells of other granulations and, by division, form new cells and thus even a deep wound will, normally, soon be filled in. While this process is going on new epithelial cells arise from the skin surrounding the wound, but, as their growth does not keep pace with that of the connective tissue cells, it is often necessary, if there is a

large area to be covered, to graft[1] skin over the denuded surface.

Appearance of granulating wounds: The granulating surface of a wound that is proceeding normally is bathed with a thin pus and the granulations are about the same color as muscle tissue but sometimes, especially when the circulation in the part is not normal or the person's health is below par, the granulations become pale and small and the surface of the wound may be either drier than is natural or the secretion may become thick and tenacious. When this condition exists the surgeon generally uses balsam of Peru or other drug that will stimulate granulation. On the other hand, if granulations are irritated by such things as retained sutures, improperly applied dressings and the like, and when the epithelial cells do not cover the granulations as they reach the surface of the wound, the granulations are likely to grow exuberantly and become soft and large and bleed easily. Such granulations the surgeon removes by cutting or by corrosion with nitrate of silver or other caustic, for abnormal granulations are conducive to unnecessarily troublesome cicatricial tissue.

Infection of Wounds

Bacteria are present in the pus of a normal granulating wound, in fact, not even wounds that heal by

[1] This consists, after the superficial granulations have been curetted to obtain favorable conditions, in spreading small thin films of skin, taken under aseptic conditions from other parts of the body, like little islands at small intervals over the denuded surface. New cells arise from these transplanted films and thus the part gradually becomes covered.

first intention are absolutely sterile, but the organisms are not of a type or present in sufficient number to cause trouble. If a wound becomes infected with a sufficient number of pyogenic bacteria the symptoms of inflammation—viz., redness, swelling, pain, and heat—will occur. These symptoms result from the increased amount of blood that collects in the part and this is due to the same causes that promote congestion when the tissue is wounded, the irritation promoting them in the latter case being the poisons produced by the bacteria. The increased amount of blood in the part, as stated on page 508, is nature's way of defending the body, for the opsonins and other antibacterial substances lessen the vitality of the bacteria and thus prepare them for ingestion by those white corpuscles known (because of their supposed manner of demolishing bacteria, etc.) as phagocytes.[1] If the phagocytes can overcome the bacteria the inflammatory products will be disintegrated by ferments, produced chiefly by the phagocytes, and absorbed. This is known as *resolution*. If, however, the bacteria win there will be great destruction of phagocytes and of tissue, for bacteria produce ferments which cause the disintegration of living tissue and the substance known as pus will be formed. This condition is known as *suppuration*. Pus consists of bacteria and their toxins, disintegrated phagocytes, and decomposed inflammatory

[1] From a Greek word meaning *to eat*. Phagocytes, like the one-celled aquatic animal known as the *ameba*, undergo change of shape consisting of alternate protrusions from its surface and contraction, by means of which they can move, even through the walls of the capillaries, and enclose bacteria and other foreign particles with which they come in contact. Also, by virtue of ferments which they secrete, it is thought, they digest the substances they take up in this manner.

products and tissue. If a cavity is formed by the disintegration of tissue and retains the pus formed in the process it is known as an *abscess*. If the infection spreads through the subcutaneous cellular tissue, it is known as *cellulitis*. Unless pus can drain freely from a part where it is formed some constitutional symptoms will occur because the toxins produced by the bacteria, the toxic matter resulting from the disintegration of cells and, sometimes, even the bacteria will be absorbed.[1]

The organisms that most frequently cause infections in wounds are: The staphylococci pyogenes[2] albus,[3] the staphylococci pyogenes aurus,[4] the bacilli pyocyaneus,[5] the bacilli coli communis, the streptococci pyogenes, and the streptococci erysipelatis.

Both varieties of staphylococci, but especially the albus, are constantly present on the skin and in the mouth and, sometimes, in the intestines; thus they are very common causes of infection. The albus is the least virulent. The bacilli pyocyaneus is quite frequently found on the skin and in the intestines. The

[1] Poisoning due to absorption of toxins by the blood is known as *toxemia*; that due to the presence of bacteria in the blood, as well as their toxic products, is termed *septicemia* and, when the septicemia is complicated by the frequent formation of abscesses in different parts of the body it is known as *pyemia*; a toxemia due to the absorption of the products of putrefactive bacteria on body tissue and exudates is known as *sapremia*. For further information about these conditions see a textbook of Bacteriology or one devoted to descriptions of diseases.

[2] Pus producing.

[3] White

[4] Gold.

[5] Green pus. These bacteria were so-called from the color of the pus characteristic of infections produced by them.

bacilli coli communis, of which there are many types, are, as their name implies constantly present in the intestines and they are thus a common cause of infection of wounds made with anything that has been soiled with fecal matter and of peritonitis[1] following perforation of the intestines.[2] The pyogenic streptococci are not quite as generally found as the other varieties of pyogenic bacteria, but the infections they cause are much more serious.

Another, though less common infection of wounds, is that due to the bacilli aërogenes capsulatus or gas-producing bacteria. These bacilli are often present in the intestines of even healthy individuals and in soil and water, but, fortunately, they do not easily thrive in wounds for, when they do, very serious conditions are produced as they give rise to such large quantities of gas that pressure enough may result to shut off the supply of blood to the part and gangrene be caused, and, largely from the absorption of the poisonous products of this necrosis, death.

The bacilli tetani are common inhabitants of the intestines of cattle and horses, and thus wounds, made by implements used in stables or into which soil that has become mixed with manure is driven, are likely to become infected with this organism. Though the bacilli remain in the wound, they do not cause any very great disturbance there, but the toxins they elaborate are absorbed by the blood and, as they have a strong affinity for nerve cells, they combine with certain ones and convulsions result and, usually, death, unless remedial measures are taken early.

[1] What is meant by peritonitis?

[2] In what disease is perforation of the intestines likely to occur and why?

Complications of Wounds

Especially when wounds are received accidentally they are likely to be complicated by: Shock; hemorrhage; injury of special structures as bones, nerves, tendons; the presence of infecting matter; and these conditions have to be considered before the wound is dressed.

The degree of shock will depend upon (1) the extent of injury and number of nerves involved; (2) the amount of bleeding; (3) the degree of fright sustained at the time of injury, and this will depend, not only upon the nature of the accident, but, also, upon the disposition of the individual. For symptoms of shock see Chapter XVIII. The treatment, as far as the nurse is concerned, consists in putting heat around the patient; keeping her quiet, mentally and physically; lowering the head of the bed, except when there is danger of hemorrhage in some part above the heart; and, in severe cases, putting on a tight abdominal binder or a weight on the abdomen; the reasons for this were given in Chapter V.

The severity of a hemorrhage will depend, as a rule, upon the size of the blood-vessels injured and the nature of the wound; a clean cut wound, such as is made with a sharp knife, is likely to bleed more freely than a contused or lacerated one, since the conditions existing in these varieties tend to occlude the severed ends of vessels and favor clotting. For methods of controlling hemorrhage see a book on first aid to the injured.

Though a hemorrhage is to be controlled as soon as possible, bleeding that is not severe nor uncontrollable enough to be so designated should not be checked

unless it persists for a considerable time, because there is no better method of cleaning out a wound. In fact, in some cases, it is well to place the part in a position[1] to encourage bleeding.

Because of the possibility of injury to unseen structures, the danger of infection and the advisability of having the wound sutured as soon as possible, a surgeon should be consulted when a deep wound is received.

Treatment of Wounds

Important fundamental principles involved in the treatment of wounds are as follows:

1. Nothing unsterile is to be allowed to come in contact with a wound, even a wound that is already infected.

2. Endeavor is made to disinfect an infected wound.

3. All foreign substances, as dirt, blood-clots, devitalized tissue are removed from a wound as soon as possible, for they increase the possibility of infection and prevent healing.

4. Free drainage for exudates (even blood serum) and pus is provided when these are present.

5. The physiological conditions by which the body endeavors to repair injury to its tissues (and upon which healing depends) are taken advantage of and encouraged and thus the sides of a wound are brought into apposition as soon after injury as possible, and interference with the circulation, as by tightly applied bandages, is forbidden. Partly for this reason, when it is wanted to hold the sides of a wound together, ad-

[1] What would be the nature of this position?

hesive plaster is put across it, over the dressing, in preference to enveloping the part in a *tight* bandage.

6. The wounded parts are kept at rest. This is necessary to: prevent pain; to keep the sutured parts together; and, in the case of an infected wound, to prevent the absorption of infective matter, for, it will be remembered that this is absorbed chiefly by the lymph vessels, and muscular movement accelerates absorption and also the passage of the lymph toward the ducts from which it enters the blood, thus giving the phagocytes in the lymph vessels and nodes less time to destroy the contained bacteria and, by increasing the amount of virus entering the blood at a time, giving the protective agents of the latter less chance to overcome the infection.

7. Means are taken to avoid irritation of the wound by dressings. The means employed may be the use of something that will prevent the gauze sticking to the wound, see page 522, or the omission of a dressing, as when the injured part is kept in a continuous bath of either water or hot air. Treatment of this kind is particularly likely to be used when large areas are denuded of skin, because innumerable nerve endings are then exposed and movement of dressings, even change in the surrounding temperature, will stimulate these and excruciating pain thus be caused.

The ordinary treatment of the different kinds of wounds is about as follows:

If a wound is the result of an accident, the skin surrounding it is cleansed and disinfected in the same way as the skin is prepared for an incision. An important point to remember when doing this is to wash away from the wound.

A clean incised wound is usually irrigated with nor-

mal salt solution or a mild antiseptic[1] to remove blood-clots. If the wound is deep or there is likely to be much exudation from the capillaries a small drain[2] is sometimes inserted in its lower end. If the wound is the result of an accident, it is a common practice to paint it and the surrounding skin with iodine, three per cent. The walls of the wound are then brought into apposition with sutures, a dressing of sterile gauze is applied, and, if there is likely to be any strain on the stitches or movement of the dressing, strips of adhesive plaster are put across the wound over the gauze. A bandage or binder is put on.

Such a wound is not, as a rule, dressed until time to take out the stitches. This is usually done about the eighth or tenth day. If a drain has been put in, the gauze over it is raised about the second or fourth day and the drain removed, but the dressing otherwise is

[1] Space will not permit of discussion of the antiseptics here and the pupils are referred to the *Handbook of Antiseptics*, Dakin and Dunham, the Macmillan Company. This small book should be in the library of every School of Nursing.

[2] Substances used for drains are: Strands of silk or catgut; wicking; strips of gauze with the raw edges turned in; strips of rubber tissue or rubber dam; glass tubes; rubber tubing. A so-called *cigarette drain* is made of a strip of gauze from which ravelings have been removed, surrounded, except for about one half inch at the end which is to be inserted in the wound, with rubber dam or rubber tissue. What is known as a *dressed drain* is rubber tubing, with one or more holes in the side, wrapped in gauze and, over this, rubber tissue. When drains are put in a deep wound, the number used should be noted on the patient's chart to avoid danger of any being left in the wound should they slip down. Drains are not as much used as they were before the war.

Drains act as such chiefly by capillary attraction. If this is not understood, see pages 75 and 76, *Physics and Chemistry for Nurses*, Pope, G. P. Putnam's Sons, or other textbook of Physics.

not touched, unless there are indications of abnormal conditions. After the stitches are out some surgeons paint the surface with iodine before putting on another dressing. A light dressing of gauze is usually kept over the wound until the scar is firm as the new skin is easily abraided.

If a wound has been made with a dirty object, or soil of any kind has been driven into it the irrigation must be very thorough for it is imperative that all foreign substance be removed. If such a wound is of the nature of a puncture, the surgeon will probably make an incision so as to allow of proper irrigation and cleansing. It is a common practice to paint such wounds with iodine. Unless there is special reason to fear infection, the wound will probably be sutured, and the rest of the treatment will then be the same as for the first type of wound, but the symptoms of infection must be watched for. If the dirt in the wound consists of soil from around stables or that which has been manured a dose of tetanus antitoxin is given if possible.

When a wound is associated with such severe injury that the tissue of the area is devitalized as much of this as possible is removed and the cleaning of the wound and surrounding skin is very thorough for the resistant power of such a wound to infection will be lowered. If the loss of tissue prevents the suturing of the wound, after the dressing is applied, adhesive straps will probably be put across it, if it is at all deep, both to lessen tension and to keep the sides of the wound as nearly as possible in their normal position. The nature of the dressing and the subsequent treatment of open wounds vary considerably. Some common dressings are as follows:

1. The wound is sprayed[1] with a 5 % to 8 % solution of dichloramine-T—[2] the solvents most commonly used are eucalyptol and paraffin—and the wound is then loosely filled with fluffed[3] gauze. This solution is an antiseptic, it prevents the gauze sticking to the wound, it aids in the loosening of necrotic tissue, and it stimulates granulation.

2. The spraying is omitted and the wound is filled loosely with fluffed gauze either dry[4] or wet with an antiseptic or drug that will stimulate granulation.

3. There is no dressing put on the wound, but the latter is covered with a cap[5] made of sterilized wire netting, and sterile gauze is bandaged over this. The cap must be large enough to extend an inch or more beyond the edges of the wound. The skin is protected from the metal by placing sterile gauze or cotton under the edge of the cap and the cap is secured in place with adhesive strips.

4. No dressing is applied, but the part is covered with a bed-cradle in which an electric light is suspended as described on page 266, and the cradle is enveloped with a sterile sheet or sterile towels.

[1] Atomizers or syringes of metal should not be used for this purpose for the solution corrodes metal.

[2] Such solutions must be kept in amber glass bottles for direct light causes their rapid decomposition. Blue glass affords no protection.

[3] When fluffed, gauze will absorb secretions much better than when it is folded.

[4] Dry gauze is not now generally used for dressings if it is found to adhere so firmly to the wound that it is not easily removed by moistening. This is especially the case with injuries such as burns and pressure sores.

[5] A cap can be improvised by bending wire into shape, in fact one can be made from anything that can be sterilized and is stiff enough to stand away from the wound.

5. Whatever the dressing used it is removed daily and the wound exposed to the sunlight.

When granulating wounds are dressed they are usually irrigated; if the wound is a large one the solution should be put in an irrigator; if the wound is small, especially if it is superficial, the solution is put in a sterile dressing basin and sprayed over the wound with a syringe. The care necessary in doing this is mentioned on page 533. If the granulations are small and anemic, a tissue stimulant is usually prescribed, and if the granulations are exuberant, a caustic. It is wounds of this type that nurses most frequently dress and therefore they should make a special point of noting the character of granulations and learn to recognize early signs of abnormal conditions.

Burns, ulcers, and the like are near akin, in their nature and in the treatment they receive, to granulating wounds. The first-aid treatment for a burn consists in excluding air either by immersing the part in water or covering it with a dressing that will not adhere to the wound. Gauze moistened (and kept moist) with a saturated solution of sodium bicarbonate is commonly used. The later treatment varies.

Extensive burns are often treated by keeping the part in either an antiseptic or a hot-air bath or by covering the burn with a paraffin preparation, *e. g.*, ambrine. Before applying the latter, the wound is irrigated with an antiseptic solution and thoroughly dried either with an electric drier or by patting it gently with sterile cotton. The ambrine, after being melted and cooled sufficiently, is sprayed, or applied with a brush, over the wound and about an inch of the surrounding skin. When it is solid it is usually covered with a thin layer of cotton and another coat of ambrine applied. A gauze dressing

is bandaged over this. The paraffin cast is lifted from the burn and the dressing done as just described daily. Dichloramine-T, applied as described (page 533), is another commonly used dressing, also sterile ointments spread *thickly* on gauze compresses. Enough paraffin, ointment, etc., must be used to prevent a dressing sticking to a burn and, if this is extensive, it should be so applied that it can be removed in sections to avoid uncovering a large area at a time, which allows of the stimulation of a large number of exposed nerve endings and causes great pain.

Pressure sores and ulcers also are kept clean by irrigation; dichloramine-T is now often used for their dressing; or sterile ointments, such as zinc oxid, or antiseptic powders that will dry secretions and act as tissue stimulants, such as aristol. The methods of applying such remedies were described in Chapter XIV.

Infected wounds are left open and are either treated by one or other of the methods described on page 522. or the Carrel-Dakin treatment is used, or, sometimes, when the wound is in a limb, especially an arm, the part is kept in a bath of antiseptic. Special tubs are provided for this purpose, but a shallow foot tub will answer the purpose. A very important consideration when using such baths is to make the patient comfortable. Pillows, protected with rubber cases, must be placed against the tub where they will support the part of the limb not in the bath.

Two very important points to be remembered in connection with the antiseptic treatment[1] of wounds

[1] When ordinary sterile dressings are used for wounds the treatment is said to be *aseptic*, but when antiseptics are added to the dressings or used as described above the treatment is said to be *antiseptic*.

are that (1) the majority of solutions that can be used for this purpose are unstable and they react, not only with constituents of the bacteria but also with substances in the wound—*e. g.*, the proteins of blood-serum, pus, etc.—and thus in a short time there is no active substance left to act upon the bacteria. Thus the solution must be renewed at regular intervals. (2) Every part of the wound must be in contact with the solution. If any part is protected from it by any means, the organisms there will not be destroyed and it will remain a focus from which infection may spread. Special points of importance with the Carrel-Dakin treatment will be mentioned in connection with the description of that treatment.

As soon as the wound is sterile it is sutured, unless there has been so much loss of tissue that this is impossible, in which case it must heal by granulation and is treated accordingly.

Important items for nurses to remember when preparing for and doing surgical dressings are[1]:

1. Always dress aseptic before suppurating wounds.
2. Observe all the precautions against breaks in aseptic technique mentioned in Chapter VII.
3. Moisten adhesive plaster and adherent gauze before attempting to remove them; hydrogen peroxid,[2] alcohol, sterile water, or an antiseptic solution can be used for the purpose. The moistening minimizes pain

[1] The reasons for the precautions mentioned will be appreciated if the principles involved in the treatment of wounds mentioned in the beginning of this section are remembered.

[2] Hydrogen peroxid is particularly good to use for this purpose for the oxygen which it holds in loose combination unites with organic matter in the blood, etc., and decomposes it and thus the dressing is loosened.

and the abrasion of skin by the plaster and granulations by the gauze.

4. Pull adhesive strips toward the wound on both sides and pull them quickly.

5. Use sterile forceps to remove dressings from a wound and to hold sponges that you use for wiping discharge from the skin, but do not use the same ones for handling the sterile supplies.

6. When washing the skin around a wound, wipe in the same direction as the wound or away from it (never toward it); if you wash away from the wound prevent any traction on it if necessary by placing the thumb and fingers of your left hand on either side of it, but not any nearer than necessary, on a line with the part you are washing.

7. Do not touch anything sterile with your fingers that you can handle with forceps, even when you are wearing gloves.

8. Do not squeeze a suppurating wound nor any localized collection of pus, as a boil, for doing so may force the virus through the adjacent tissues. Bier's cups are sometimes used to remove pus when force is needed (for methods see Chapter XIV.), or else the wound is laid open and the Carrel-Dakin treatment instituted.

9. If you are told to use peroxid of hydrogen in a wound, irrigate it very thoroughly afterward so as to remove all the decomposed material.[1]

[1] Hydrogen peroxid was formerly very much used in the treatment of infected wounds because blood, pus, and muscle exudates contain an enzyme that hastens the liberation of its excess oxygen and this unites rapidly with such substances as pus and blood and promotes an effervescence that forces this matter to the opening of the wound. It was found however that it also frequently

10. Remove discharge, sloughs, and the like from a wound by irrigation or with the forceps, not by rubbing with sponges.

11. Use an irrigator or syringe for irrigation, do not squeeze the solution from sponges.

12. Be very careful when irrigating a sutured wound, such as that existing after perineorrhaphy, to regulate the flow so that there will be no pressure thrown on the stitches. The parts must be thoroughly cleaned and dried by gentle pressure with sponges, but there must be absolutely no traction on the stitches.

13. When a caustic, such as silver nitrate, is to be used after irrigation, first absorb the moisture with gauze, or it may spread the caustic, but do the drying by pressing gauze gently over the part, never by rubbing it.

14. When using a caustic touch only the granulations that need such treatment, never the skin or healthy granulations.

15. When packing a wound with gauze, do not rub it and do not press the gauze down tightly; this should be fluffed and loose, otherwise it will not absorb the wound secretions readily and will thus interfere with drainage. Packing is used to facilitate drainage and to prevent the upper part of a wound closing until the lower portion is filled in with new tissue so that there will be no pocketing of pus.

16. When discharge from a wound irritates the skin, the latter is covered with sterile vaseline or ointment.

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forced it into the adjacent tissues and irritated the wound and thus it is not now used as much as formerly; the Carrel-Dakin treatment or, in some cases, application of Bier's cups being substituted.

17. Always notice, report, and record any abnormal condition in a wound. Record any change made in the dressing[1] and the number of drains or pieces of packing inserted.

18. Always reinforce a dressing as soon as discharge comes through to the surface, for not only does the soiled dressing look unsightly, but the gauze is no longer impervious to germs and the discharge affords favorable conditions for their propagation.

Demonstration 88

Dressing Wounds

Requisites: 1. The dressing carriage with the usual supply of dressings, sterile towels, gloves, solutions, instruments,[2] sterile and unsterile bowls, and lotion glasses, dressing rubbers, paper bags or whatever receptacle is used to receive waste dressings, adhesive plaster.

2. Kelly pad.
3. Pail.
4. Irrigator stand.
5. Irrigator with tubing provided with clamp.

Preparation of the dressing carriage: (Note should

[1] A change of dressing is of course only made upon the surgeon's prescription.

[2] For the dressing of a closed wound two pair of sterile forceps will probably be the only instruments required. If stitches are to be taken out a pair of sharp-pointed scissors will also be needed.

For an open wound two pair of forceps, a pair of scissors, a probe, an irrigation tip and syringe will be needed. There must always be a dairy thermometer and a long pair of dressing forceps in a deep glass or bottle containing alcohol 95%. The latter is to be used for taking dressings, etc., from the jars.

be made of the regulation equipment of the dressing carriage for, when preparing it for use, one of the very important essentials is to make sure that everything likely to be required is on it and in its place. Having a regular place for everything on a dressing carriage makes it very much easier to be sure that nothing is missing.)

When a number of dressings are to be done, as many dressing[1] and kidney[2] basins and lotion glasses[3] as will be required are sterilized and piled between the folds of a sterile towel upon the top shelf of the carriage; the instruments likely to be needed are sterilized and placed in the instrument tray between the folds of a sterile towel; a sterile dish with a pad of gauze in the bottom is placed on the top shelf to receive instruments after they have been used[4]; the bottles of alcohol, ether, and other small ones containing liquids likely to be needed are left on the top shelf and their rims are washed with alcohol or other disinfectant, a sponge wet with disinfectant is placed over the stopper and another around the neck of each bottle; a bundle of sponges and one of gauze fluffs are placed in sterile dressing basins; they are left in their wrappers but these are arranged so that they can be easily opened with forceps. Solutions used for irrigation and syringing should be about 100° to 105° F.; it is well to have both hot and cold solutions on hand; they are usually kept until needed on the lower shelf of the carriage and a folded towel should be placed under the flask of hot solution.

[1] Basins for solutions and sponges.

[2] Basins used to catch drainage.

[3] These are used for hydrogen peroxid, alcohol, and the like.

[4] This dish is sterilized because as it, for convenience, is on the top shelf it may come in contact with sterile supplies.

The bandages, binders, dressing rubbers, and other unsterile articles are placed on the lower shelf and a vacant space is left on this shelf on which to put dressing bowls after use. The place for the receptacle to hold soiled sponges varies; Fig. 50 shows a dressing carriage

Fig. 50. Dressing carriage.

with two large metal boxes on one end; one of these boxes is intended to hold a paper bag in which the soiled sponges and dressings are put and the other one is for used dressing towels. A metal slab divides these boxes from the rest of the carriage. The irrigator, after being sterilized, is generally hung on the stand and covered with a sterile towel. The same irrigator

can generally be used for a number of dressings, a fresh tip being attached for each dressing.

The assistance that a surgeon requires from a nurse when dressing wounds usually consists in the preparation of the patient, placing the dressing carriage in position, lifting the covers of jars, etc., that he may get sponges and dressings when required, pouring out solutions and arranging for irrigation when necessary, putting on the bandage or binder. To do even these things well, however, requires concentration of attention and endeavor to remember how the different surgeons whom you assist like things done, for, though the general order of procedure in doing dressings is generally about as described on page 532, surgeons vary more or less in the details of their methods, the solutions they use, etc.

When there are a number of dressings to be done and there are two nurses to assist, one prepares the patients, except removing the dressings, does the bandaging, makes each patient comfortable as soon as the dressing is done, and resterilizes the instruments, etc., if necessary, while the other nurse, whose hands are disinfected and covered with gloves, removes the dressings and assists the surgeon.

Procedure in the preparation of the patient: If irrigation is to be used, draw the patient to the side of the bed and make her as comfortable as possible. Place rubber and, if necessary, the Kelly pad in position to protect the bed.

Turn the bedclothes back to expose the wounded area and, if this entails exposure of other part of the body, *e. g.*, the chest, cover it with a shoulder wrap.

Remove the bandage or binder.

Unless there is a second nurse whose hands are dis-

infected, wash and disinfect yours and then remove the outer layer of dressing, all that does not adhere to the wound. If there is adhesive plaster over the dressing moisten the parts adhering to the skin with, preferably, peroxid of hydrogen, but alcohol, sterile water, or solution can be used, take hold of one end and pull it quickly toward the wound; do likewise to the other end.

Place sterile towels in place to protect the wound and dressing from the bedclothes. If the dresser is not ready put one of the sterile towels over the wound.

Procedure in dressing a clean wound: Disinfect your hands and assume gloves.

Moisten the adherent gauze with peroxid of hydrogen or sterile solution; this can be poured from a small glass or sprayed over the gauze with a syringe.

Take hold of the gauze with forceps and remove it, but use no force; if it is still adherent moisten it further.

If the wound is a closed one, all that will be necessary, unless stitches are to be removed, will be to wash the skin surrounding the wound with alcohol or ether to remove dried epithelium and the remains of the adhesive plaster and then cover the wound with a fresh fluff of sterile gauze; put on the adhesive straps and the bandage or binder.

To remove skin sutures: Take hold of a suture on one side of the knot with the forceps, cut it on the other side as close to the skin as possible, and then draw it gently backward and out.

Some surgeons have the suture holes painted lightly with 3% iodine and others prefer that a compress wet with alcohol be put over the part for a few minutes before the dressing is applied. The latter

usually consists of a fluff of sterile gauze secured in place with adhesive plaster and a bandage.

If the wound needs irrigation make sure that the bed is properly protected.

Remove the adhering dressing and packing; while doing this it may be necessary to moisten the gauze frequently.

If only a small amount of irrigation is required, have your assistant hold a sterile kidney basin in position to receive the discharge, otherwise the Kelly pad is used. While irrigating direct the current so that, except where there are sutures, it will fall quite forcibly against the surface of the wound, and make sure that every portion of the wound gets its turn. If the wound is a deep one it is often advisable to have the patient lie part of the time in such a position that the wound can be filled with solution and then turn so that it will flow out.

If a caustic is needed, follow the directions given on page 527 and then apply the prescribed dressing.

Demonstration 89

Carrel-Dakin Treatment of Wounds[1]

Requisites: 1. Two pair of sterile forceps.
2. Sterile scissors.
3. Sterile gloves.
4. Sterile towels.

[1] Instructors who are not familiar with this treatment should consult either *The Treatment of Infected Wounds*, Alexis Carrel and G. Dehelly, Paul B. Hoeber; or *Technique of the Irrigation of Wounds by the Carrel Method*, J. Dumas and Annie Carrel. Translation by Adrian V. S. Lambert. Chicago Medical Book Company.

5. A sterile dressing basin containing Dakin's solution.

6. Sterile gauze compresses.

7. Gauze squares sterilized in vaseline.[1]

8. Sterile pads.[2]

9. Sterile safety pins and spring clothespins.

10. A bed cradle.

11. A Bradford frame or suspension or traction apparatus will probably be used if the wound is complicated with a fracture or if it is on the under surface.

12. An irrigator stand.

13. Dakin's solution.[3]

[1] Pieces of gauze 8 or 10 cms. (about 2½ to 3 inches) square are placed in vaseline and sterilized in the autoclave. Gauze with 24 threads to the inch is best for the purpose. These pads are put around the wound, as described later, to protect the skin from the solution.

[2] These consist of a layer of absorbent cotton and a layer of non-absorbent cotton surrounded with gauze and stitched around the edges. The pad is made large enough to surround the part of the body in which the wound is located and to extend three or four inches above and below the wound. Such pads are intended to protect the bed from moisture should there be any overflow from the wound. The absorbent cotton, which is placed next the skin, absorbs the moisture and the non-absorbent cotton prevents its ready escape, but does not interfere to any extent with evaporation, as rubber or similar material does.

[3] The essential constituent of Dakin's solution is hypochlorite of soda. Soda and, sometimes, boric acid are added to lessen the irritability of the hypochlorite. The solution is prepared by the pharmacist but the description of the Daufresne's method (which is the one in common use at the present time) is given here as a matter of interest.

The constituents and amounts to make 10 liters of solution are as follows: Chlorid of lime (having 25% active chlorine) 184 gm.; carbonate of soda (either anhydrous, carbonate de soude Solvay, Fr. 92 gm. or crystals 262 gm.); bicarbonate of soda 76 gm.

14. The Carrel apparatus. This consists of (1) a reservoir for the solution. (2) Tubing of red rubber with a caliber of 7 mm.; this is attached to the reservoir and must be of sufficient length to allow of the latter being hung about three feet above the wound. It is to be provided with a clamp. (3) A Y-glass connecting tube is required if there is more than one wound or if a wound is so large that two distributing tubes are required; the straight arm of the tube is inserted in the irrigator tubing and a piece of rubber tubing (the same kind as that on the irrigator) about ten to twelve inches in length is attached to each branch. If the continuous instillation method[1] is used a dropper such as that used with the protoclysis outfit and one short piece of tubing will be needed instead of the Y-tube. (4) A glass distributing tube or two if a Y-tube is used. Distributing tubes with one, two, three, or four outlets are to be had. Those with one outlet consist of a straight tube with a bore of 7 mm. at one end and 4 mm. at the other, those with more than one outlet consist of a straight tube with a bore of 7 mm. which is attached to the irrigator tubing and branches with a bore of 4 mm. projecting from the sides.

It is prepared as follows: In a 12-liter flask put 200 gm. of chlorid of lime and five liters of tap water. Shake this vigorously two or three times and let it stand over night. Dissolve the carbonate and bicarbonate of soda in 5 liters of cold water. Pour the soda solution into the flask with the lime, shake this very vigorously for a full minute, and then allow it to stand for half an hour that the carbonate of lime may settle to the bottom of the flask. Then siphon off the clear liquid and filter it through doubled filter paper. The liquid must be perfectly clear. It must be kept until needed in a cool place and away from the light.

[1] There are two methods of instillation used, continuous and intermittent.

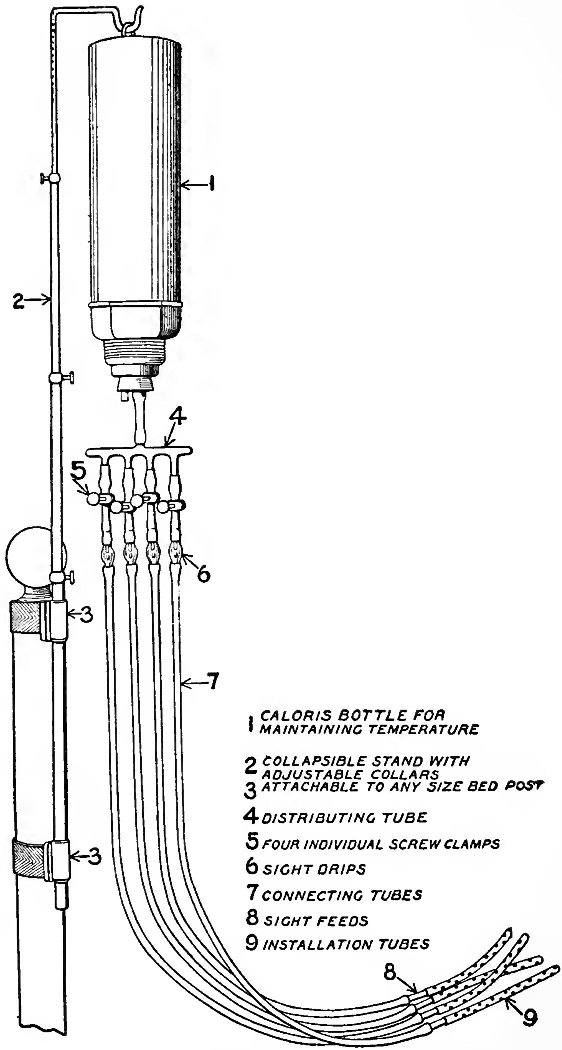

Fig. 51. The Mulford Carrel-Dakin Apparatus.

(5) Rubber instillation or conduction tubes, one for each branch of the distributing tube or tubes. These tubes are of red rubber with an interior diameter of 4 mm. They must be flexible so that they can be bent to follow the contour of a wound and yet firm enough to resist the pressure of the muscles. They are arranged for use in four ways[1]: (1) The tubes are cut in lengths of 30 to 40 cm. (approximately 12 to 16 inches); they are closed at one end by a suture and holes with a diameter of about ½ mm. are made at regular intervals around the sides of this end of the tube, about eight holes to each 5 cm. of the tube punctured. The length to be punctured will depend upon the size of the wound. The holes must not come above the surface of the wound. As a rule a tube of 30 cm. long is punctured over a length of 5 to 10 cm. and one 40 cm. in length for 15 or 20 cm. (2) The second type is the same as the first but a piece of Turkish toweling is rolled about the segment in which the holes are made. This must be firmly fixed by sewing so that there will be no danger of its being left in the wound when the tube is withdrawn. It is intended to aid in distributing the liquid which passes through the holes. It is only used for surface and small wounds in which there is not much discharge, for if there is discharge present, it is absorbed by the toweling and forms a coating over it that interferes with the distribution of the fluid. (3) The third variety, which is used for surface wounds, is left open at both ends and these

[1] Tubes ready for use can now be purchased, but it requires only a little care to prepare equally adequate ones as described above. In writing this description the author has consulted *Le Traitment des Plaies Infectées*, Carrel et Dehelly, Masson et Cie., Paris.

are put over the branches of the Y-tube (so that the instillation tube is almost in a circle). The tube is cut a suitable size for the wounds and the holes are punched in the sides of the middle third of the tube, where they will allow of the solution flowing over the surface of the wound. The shape of the circle can be altered as required by tying with a piece of suture. (4) In the fourth method, the tube is left open at both ends, and about ½ cm. above the opening which is to go in the wound, a hole 4 mm. in diameter is made. This type of tube is used for continuous instillation.

Important points to be considered in connection with the Carrel-Dakin treatment of wounds are:

1. The solution must be properly prepared, otherwise, it may be very irritating to the skin and useless as a wound disinfectant.

2. Antiseptic technique must be carefully maintained.

3. The tubes are to be so placed in the wound that the solution issuing from them will come in contact with every particle of its surface; thus, if there are cavities or crevices, the tubes must be suspended in them in a manner to allow of the surfaces of their walls being thoroughly bathed; if a wound is relatively long transversely a tube is laid along its floor.

4. The tubes must not be placed near enough together to block the apertures in their walls.

5. There is to be no gauze in the interior of the wound for it will absorb the secretions and thus become somewhat impervious to the solution and interfere with its bathing the wound.

6. The tubes must be secured in place as otherwise they may slip after the pad is in place and some part of the wound may then be deprived of its share

of solution; the upper part is particularly likely to suffer from such cause.

7. The action of the apparatus must be inspected before the wound is covered and, occasionally, afterwards when the clamp is opened to supply the wound with fresh solution.

8. If the intermittent method of instillation is used, the solution must be allowed to run into the wound every two hours punctually.

9. The quantity of fluid introduced must be as much as the wound will hold without overflowing. A comparative estimate is about 10 c.c. for each tube used, but the amount that can be used has to be ascertained with each wound. If the right amount is used, the wound will be filled at the time of instillation, but the fluid will practically have all evaporated at the end of two hours. If too much solution is used the gauze with which the wound is covered, and the pad, will not be able to contain it all and the bed will become wet. If there is not enough used the wound will not be sufficiently disinfected and there will probably be pus in the wound at the next dressing and the daily bacteriological count will show little or no diminution in the number of bacteria. To use too little solution is even worse than to use too much.

10. The pressure with which the solution is allowed to enter the wound should not be greater than that gained by placing the reservoir, or if the continuous method is used, the lower level of the dropper, three feet above the wound. Pain is likely to be caused if the pressure in the wound is too great.

11. A tube with the lateral perforation is to be used for the drop (continuous) method as there will not be enough liquid flowing through the tube at a

time to force its way through the numerous minute apertures.

Procedure when arranging for an intermittent instillation: After the utensils have been collected and sterilized[1] and the irrigator tubing connected to the reservoir, hang the latter on the stand, close the clamp on the tubing, put the solution into the reservoir.

Make the patient as comfortable as possible in the best position for the retention of fluid in the wound. Put a pad under the part, placing it so that when, later, it is brought around the ends will meet over the wound.

Prepare the wound as for an ordinary dressing.

The dresser in the meantime prepares his hands and puts on gloves. He then surrounds the wound with sterile towels and connects the conducting tubes to the glass distributing tube. While doing this he touches the tubes only at the point of connection with the distributing tubes; the portions of the tubes which will go in the wound are kept in the sterile towel in which tubes were placed when they were taken from the sterilizer, until they are put in the wound. The end of the main arm of the distributing tube is then inserted in the irrigating tubing, or if a Y-tube is used, the tubing connected with this.

The dresser then takes the towel with the tubes upon it in one hand and places the tubes, one by one, where it seems advisable.

You will then be required to open the clamp so that the solution may flow into the wound. Be ready to close the clamp if the dresser needs to adjust the tubes. Watch

[1] The tubes are sterilized by boiling them for five minutes. They are taken from the sterilizer with forceps and placed between the folds of a sterile towel. The rest of the apparatus is sterilized in the usual manner for utensils of similar material.

the amount of fluid that is used because the quantity required to fill the wound will be the amount that will be needed for its subsequent refilling. If the irrigator is not a graduated glass one, the time required to fill the wound should be marked for subsequent guidance.

The dresser then puts compresses, wet in Dakin's solution, over the wound and arranges them so that they will help to keep the tubes in place. Next squares of vaselined gauze (in about two layers) are put over the skin around the wound. These are taken from the jar in which they were sterilized with sterile forceps. Because of the vaseline, they will adhere securely to the skin and thus protect it should there be any overflow of solution from the wound. This is necessary as the solution irritates the skin.

The pad is then brought around the part and, if the position of the tubes does not allow them to emerge where the pad is to be fastened, slits to accommodate them are made with sterile scissors. The pad is secured with either sterile safety pins or spring clothespins.

The tubes are then secured in place on the highest level of the part with safety pins which are put through the pad and over the distributing tube or tubes at the connection with the irrigating tubing. It is important that the glass be included as, otherwise, the grasp of the pin will not be sufficiently secure.

As previously stated the clamp is to be opened for a few seconds to allow of the wound being filled with solution every two hours and, as often as necessary, the pad must be unpinned and the position of the tubes noted and adjusted if necessary.[1] The total

[1] This will depend considerably upon the wound for in some wounds it is relatively easy to adjust the tubes securely and in others quite difficult.

quantity of fluid injected in twenty-four hours usually averages between 250 and 1200 c.c. according to the size of the wound.

The wound is dressed every twenty-four hours and each time this is done a culture is taken. The dressing usually consists in the removal of the compresses, the inspection of the tubes and their readjustment if necessary, the application of fresh compresses and, if necessary, a new pad.

The length of time required for this treatment to be effectual, *i. e.*, for the wound to become sterile, depends upon the length of time that the infection has been in progress, the amount of necrotic tissue present, and the perfectness of technique. It

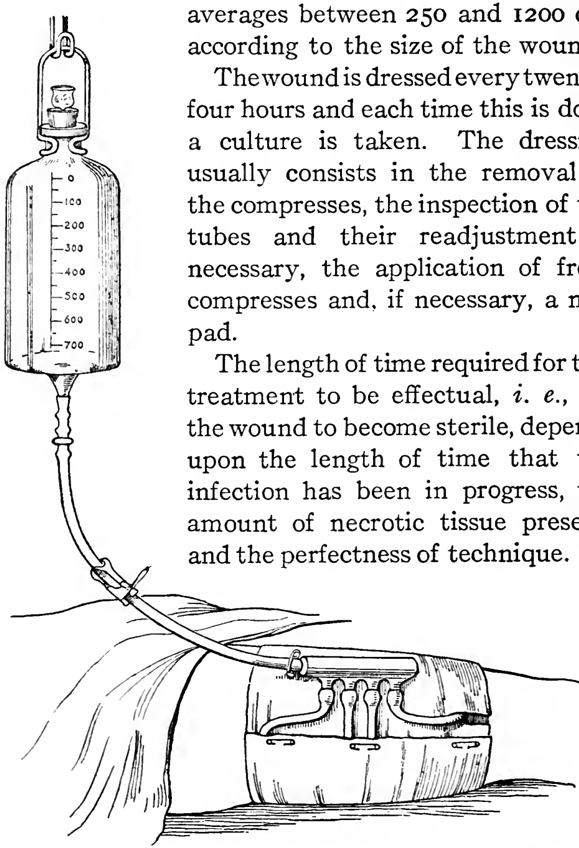

Fig. 52. Carrel apparatus in use for wound of thigh. Showing the conduction tubes inserted where the pad is pinned and in a slit made in the lower edge of the pad.

has been found that when the treatment is commenced early and properly carried out even severe infections may be overcome in from five to twelve days.

Procedure when arranging for continuous instillation: This, except for the following differences, is similar to that for an intermittent instillation. A short piece of tubing such as attached to the Y-tube is attached to the irrigator, this is provided with a screw clamp that will serve to control the flow of solution, and a dropper such as that used for the drop method of the protoclysis is inserted in the free end[1]; the longer irrigating tubing is attached to this, and to the latter, a straight distributing tube with one conducting tube of Type 4. The rate of flow is regulated to about five or six drops per minute. This method of instillation is used for small wounds in which the liquid will remain in quantity.

After use the tubes are syringed out with first cold and then warm water, scrubbed with a brush, soaked all night in Dakin's solution, washed and syringed with ether, and then boiled for thirty minutes in a sodium carbonate solution.

* * * * * * *

This demonstration should be followed by one showing the various means of arresting hemorrhage. The procedure for such a demonstration is not included in this volume because it would require considerable space and there are so many excellent books on First-Aid Treatment in all school libraries.

[1] The bottom of the dropper, it will be remembered, is to be about three feet above the wound.

CHAPTER XVIII

Symptoms

Nature of symptoms. Methods of physical examination. Significance of symptoms that it is of special importance for nurses to note. Nature of blood tests and functional tests. Use of vaccines in diagnosis. Methods of obtaining cultures from throat.

Symptoms have been defined as *signs or evidence of disease or of change in a patient's condition.* Conditions that are complained of by the patient, but are not evident to the examiner, are termed *subjective symptoms*, those manifest in any way to the examiner are classed as *objective symptoms.* Conditions that are observed early in a disturbance, as during the period of incubation of an infectious disease, are called *prodromal symptoms.* Conditions discovered by the methods classed as physical examination are spoken of as *physical signs or symptoms.*

The methods employed in physical examination are: (1) Inspection or visual observation, used to note the general condition of the body and any visible evidence of faulty nutrition, change in contour, the presence of swelling, rash, abnormal expression, or color of the skin, condition of the eyes, ears, etc., in fact, any visible departure from the normal. (2) Manipulation or the handling of parts to ascertain if any abnormal limitation of movement exists. (3) Mensuration or measuring, employed chiefly to dis-

cover inequalities on the two sides of the body; it is used more especially after fractures. (4) Palpation, or examination by touch, to determine the presence of (a) tenderness; (b) departure from the normal in the vibration or *fremitus* that is induced by movements of the organs in the cavities and by such acts as coughing, breathing, etc.; (c) variations from the normal in the degree of firmness of the tissues; (d) the presence of tumors; (e) fluctuations which indicate the presence of fluid in a part. (5) Auscultation or listening to detect the nature of sounds within the thoracic or abdominal cavities. In describing certain sounds arising from abnormal conditions of the valves of the heart, or of the blood-vessels (as aneurysm), or conditions of the blood such as exist in severe anemia, the term *murmurs* is used; and many of the abnormal sounds heard in the lungs are called *râles* (from a French word meaning *rattle*); examples of these are dry râles heard chiefly when there is some bronchial obstruction, as in asthma and bronchitis; moist râles, caused by the presence of liquid in the tubes; crepitant râles, a crackling sound heard especially in the early stages of croupous pneumonia; subcrepitant râles, fine moist râles heard in conditions associated with fluid in the bronchioles of the lungs; mucous râles, caused by bursting of viscid bubbles in the bronchial tubes. What are known as *friction sounds* are produced by sides of inflamed membranes, as those of the pleura and pericardium, rubbing upon each other. (6) Percussion or striking parts with sharp, short blows produces sounds of varying resonance which are of aid in determining the thickness of underlying structures, the elasticity of the tissues, and the presence of fluid.

Other common measures employed for the detection of abnormal conditions of the body are: The use of appliances such as the thermometer, cardiograph, sphygmomanometer, etc.; the examination of excreta with the unaided eye, with the microscope, and with chemical tests; the microscopical and chemical examination of the blood, pathological secretions and specimens of tissue; röntgenoscopy, or examination by means of the X-rays; vital function tests.

The symptoms that nurses are held responsible for ascertaining and reporting are visible physical changes; alteration in the temperature, pulse, and respiration; abnormal conditions of excreta, vomitus, etc., that can be seen without the aid of a microscope; those complained of by the patient.

It is really marvelous how little the majority of people observe unless they take the trouble to cultivate the habit of noting their surroundings and for many reasons it is most important that nurses should do this; two reasons as regards symptoms are: (1) unless signs of abnormal changes are recognized early treatment may not be started in time to save the patient's life; (2) the physician makes his diagnosis and bases his treatment upon the symptoms that occur and for knowledge of many of these he must depend upon the nurse.

The more common physical objective and subjective symptoms that it is important for nurses to note and their possible causes are as follows:

Changes in the odor of the breath that it is especially important to observe are: A sweet odor, usually due to diabetes; an odor of urine, common in uremia; a fetid odor: this may be due to decayed teeth, rhinitis, tonsillitis, or purulent or degenerative disease of

some part of the respiratory tract, or gastric disturbances.

Chill, which is an attack of involuntary contraction of the voluntary muscles, is brought about by overstimulation of nerve centers. The stimulation may be of psychic origin, or the result of exposure to cold, or the effect of poisons, and the latter may be either taken into the body, *e. g.*, drugs, or formed within the body by bacteria, or as the result of defective metabolism or of imperfect elimination. Points regarding a chill to note and record are: its severity, duration, and effect upon the temperature, pulse, and respiration.[1]

Convulsions are of the same nature as chills, but the muscular contractions are more violent. Like chills they are usually due to intense stimulation of nerve centers and, with the exception of exposure to cold, the same kind of stimuli will produce convulsions. As a rule, a convulsion will point to a stronger stimulus than that occasioning a chill, but a stimulus that will cause adults to chill will promote convulsions in children, because their nervous system is much more readily stimulated. Other common stimuli that promote convulsions are: pressure upon nerves or nerve centers[2] and, especially in children, stimulation of nerve endings in the stomach or intestines by undigested food, worms, etc.

In some individuals, convulsions may be due to over-irritability of nerve centers rather than excessive irritation for very slight stimulation will give rise to a convulsion, and in the condition known as *idiopathic*

[1] What will you do for a patient who has a chill?

[2] If a convulsion is due to pressure on the right side of the brain which side of the body will be involved? Why?

epilepsy, convulsions often occur unassociated with any definite discoverable cause.

Convulsions in which the contractions are intermittent are termed *clonic convulsions* and those in which the contractions are long continued are said to be *tonic*. Convulsions may be either general or local; the latter are sometimes termed *spasms*. Sudden attacks of convulsions occurring as the result of a temporary cause (*e.g.*, convulsions in pregnancy and those in children produced by the irritation of worms or food) are termed *eclampsia*.[1]

Points to record concerning a convulsion are: whether it is general or local and, in the latter case, the part or parts involved; whether tonic or clonic; the duration of attacks; if there was loss or retention of consciousness during the attack; whether the eyes were affected and in what way; effect upon the color, pulse, and temperature; whether there was frothing at the mouth or other abnormal condition.

Changes of color should be noted for they are typical in many conditions and it is especially important to observe a relatively sudden pallor for this is an indication of hemorrhage and shock. Progressive pallor involving the nails, ears, conjunctiva, and mucous membranes will occur as the result of reduced hemoglobin,[2] with or without a reduction of cells, and as the result of poor circulation; also various peculiar forms of pallor are seen in morphine and cocaine habitués, malignant diseases, nephritis, leukemia. In Addison's disease, the skin is brown or yellow and it is also yellow when there is bile in blood and

[1] What will you do for a patient who has a convulsion?

[2] What is the normal percentage of hemoglobin in the blood? See page 582.

tissues (jaundice). A flushed skin may indicate fever; a particularly bright red color of the cheeks or dusky red in patches is often seen in pathological conditions of the mitral valve; a unilateral flushing of the face is common in lobar pneumonia involving only one lung; a florid blotchy complexion frequently results from continued overindulgence in alcoholic beverages; a bluish or purple tint—termed cyanosis—indicates improper aeration of the blood; this may be due to many causes since it may result from any condition which interferes with breathing or the pulmonary circulation or from any great reduction of hemoglobin. In silver poisoning—known as argyria—the skin assumes a peculiar bluish or gray color.

Coma is a state of prolonged unconsciousness from which the patient cannot be aroused. It is a sign of severe depression of the nervous system.

Coughing is usually a symptom of irritation in some part of the respiratory tract, but it is sometimes the result of stimulation of nerves with centers proximal to the vagus. Two coughs that are of special importance to recognize are the hoarse *crowing* cough of croup and the more or less convulsive cough, followed by a whoop, that is characteristic of whooping cough. Points of special importance to note in connection with a cough are if it is associated with pain, the location of the pain, and if there is expectoration.

The nature of a child's cry and accompanying actions are often of diagnostic value. The normal cry of a healthy baby is loud and strong; if due to temper, the cry will be usually accompanied with kicking of the legs and stiffening of the body and the infant will cease crying when it gets what it wants; when the cry is provoked by hunger it is generally continuous

and fretful and the child is likely to suck its fingers and cease crying when it is fed; when caused by pain, a cry is usually sharp and strong and accompanied by signs of distress such as contortion of the features and, especially when the pain is due to colic, drawing up of the legs; the cry of illness is generally moaning and feeble, but in cerebral diseases such as meningitis and hydrocephalus, there is likely to be a typical strong, ringing cry.

Cyanosis; see under color.

Delirium may be induced by, and thus is a symptom of, conditions that prevent the cerebrum[1] functioning properly. Common causes are: (1) The action of alcohol upon brain tissue, or that of the toxins produced by bacteria or those formed during metabolism and not eliminated; (2) lack of blood in the brain; (3) insanity.

Delirium may be manifested by great mental excitement and the patient may be extremely violent, strong, and noisy, or the delirium may show chiefly in inability to recognize surroundings and the possession of irrational ideas; the patient is likely to be more or less restless and to want to get out of bed but, unless opposed, is neither very excited nor violent. When delirium occurs in the course of exhausting diseases, such as typhoid, the patient is likely to talk a great part of the time in a low, muttering, unintelligible manner. Delirium may occur suddenly or it may come on gradually, the patient growing constantly more restless and, when the condition is due wholly or in part to alcoholism, possessed of terrifying ideas. Such symptoms should always be noted and reported for

[1] What part of the brain is the cerebrum? What are its functions?

the violent and exhausting delirium of alcoholism (*delirium tremens*) can often be averted if treatment is started in time. This delirium is particularly likely to occur in pneumonia and following accidents when the patient has been addicted to the overuse of alcohol.

Dizziness or vertigo is common in the following conditions: Neurasthenia; states which induce anemia of the brain; intoxication with alcohol or autogenous poisons; diseases of the middle ear, especially of the semicircular canals; pressure upon the ear drum by wax or other foreign substance; eye strain; subjection to unusual forms of motion—this probably causes vertigo as the result of its effect upon the eyes and the lymph in the semicircular canals.[1]

Dysphagia or difficult swallowing is usually due to either: Inflammation of the throat; stricture of some part of the esophagus such as is caused by cicatrix or pressure upon it by tumors; hysterical spasm of the esophagus; paralysis of the muscles of deglutition. The last-mentioned condition is a common complication of diphtheria and regurgitation of food is a primary symptom; thus, whenever this happens it should be reported.

Dyspena; for this and other symptoms connected with breathing see Chapter V.

Edema and dropsy are terms applied to abnormal collections of serous fluid in tissue spaces and body cavities. The condition may be localized or it may exist in almost all parts of the body. Its more common causes (and thus the conditions of which it is a symptom) are: Diseases of the viscera (chiefly the

[1] Where are the semicircular canals and what is their function? If unable to answer read the section on the middle ear in textbook of Anatomy and Physiology.

heart and liver) which interfere with the venous circulation; interference with the venous circulation by the pressure of tumors, thrombi, etc.; nervous conditions which interfere with normal innervation of the circulatory organs; the retention of fluid in the system because of failure of elimination by the kidneys; lessened absorption of lymph, which is usually the result of poor circulation; increased permeability of the capillaries; changes in the composition of the blood; collection of fluid in the body cavities may also occur as the result of inflammation of the membrane lining the cavities or the contained organs. The parts of the body in which edema is of greatest danger to life are the throat, lungs, and pericardial sac. In the early stages of disturbances which cause edema this condition may not be very marked or it may only show at times and thus is likely to escape notice unless the nurses are observant.

Eruptions on the skin occur from many causes. A characteristic rash is one of the most reliable diagnostic symptoms of the diseases classed as exanthemata; a rash is also a symptom of overdosing by certain drugs. Urticaria or similar eruption is often caused by certain proteins as those in antitoxin sera, and even those of some foods will cause urticaria in some individuals, as will also irritation of the gastro-intestinal, pulmonary, and genito-urinary mucous membranes. Macules, *i. e.*, discolored spots that are neither elevated, nor depressed, are common in the secondary stage of syphilis. Petechiæ, or small spots formed by the effusion of blood occurring in disease, are usually due to deficiency of some of the blood constituents necessary for its coagulation or to excessive permeability of the blood-vessels. Petechiæ are typi-

cal of the disease known as purpura hemorrhagica and they occur in severe infections of diseases such as cerebrospinal meningitis, smallpox, yellow, typhus, and rheumatic fever. Petechiæ are also produced by the bites of bedbugs, body-lice, etc. Sudamina are whitish vesicles caused by the retention of sweat in the sweat ducts or the layers of the epidermis. Important points to notice about eruptions are: Where they first appear, if and in what order they spread, if they are associated with fever, or other abnormal phenomena.

Change of expression of the face is often an important sign. A pinched, anxious expression is a symptom of hemorrhage and shock and it frequently develops as a patient's condition grows worse; it is also common in abnormal heart conditions. A dull apathetic expression is indicative of debility and of mental derangement; it is particularly marked in typhoid fever and its disappearance is considered a good sign. An over-alert, excited expression or a continually melancholy one usually are indicative of mental derangement.

The eyes being one of the chief factors in facial expression, the symptoms classed under that heading are equally associated with these organs and, in addition, certain other unnatural appearances may be induced by both local, distant, and systemic conditions. Some of the more common ones are: (1) Myosis or contraction of the pupils, the most frequent causes of which are opium poisoning, uremia, paralysis of the sympathetic nerve fibers supplying the pupil, pressure on certain parts of the brain, dementia, locomotor ataxia, old age. (2) Mydriasis or dilation of the pupil, seen chiefly in severe shock and collapse, atropine poisoning, paralysis of the third nerve, hysteria, epilepsy. (3) Inequality of the size of the

pupils; slight inequality sometimes occurs in health, especially in nervous individuals, but marked inequality is likely to be due either to ocular defects, pressure on certain parts of the brain, or organic brain disease. Occurring in the course of meningitis it denotes involvement of the cranial nerves. (4) Deflection of the eyes to one side is a common symptom of cerebral hemorrhage or brain tumor. (5) Redness of the conjunctiva—bloodshot—is seen in fever, eye strain, irritation, and diseases of the eye, and it is sometimes present to some extent more or less constantly when heart lesions exist. (6) Yellow discoloration of the conjunctiva is generally a symptom of jaundice. (7) Protrusion of the eyeball is a symptom of exophthalmic goiter. (8) Lacrimation is one of the earliest symptoms of measles. (9) Puffiness of the tissues under the eyes is due to the same causes as edema in other parts of the body, but it is to be especially regarded when the patient is getting arsenic for it is one of the first symptoms of overdosing, being occasioned by increased permeability of the capillaries induced by the drug. (10) Inflammation of the eyelids may be due either to conditions affecting the lids themselves or to eye strain or disease. (11) Photophobia, or intolerance of light, is usually due to conditions affecting the optic nerves; occurring in the course of brain diseases it generally signifies their involvement.

Symptoms connected with the gums, teeth, tongue, mouth, and throat may arise both as the result of local and systemic conditions. Some of the more common ones are: A soft spongy condition of the gums associated with tenderness and a tendency to bleed easily—this is often seen in syphilis, scurvy, alveolitis, and

other infections or irritations in the mouth; swelling of the gums with tenderness and salivation—a condition known as *ptyalism*—is a symptom of mercurial poisoning and of severe local infections and irritations; a blue line on the gums is seen in chronic lead, copper, and silver poisoning; small milk-white elevations which, when removed, leave an abraided surface are typical of thrush; small red spots surrounded by white specks on the gums and cheeks are a prodromal symptom of measles and are known as *Koplik's sign.* Delayed dentition and badly formed teeth are a symptom of rickets and of syphilis, but these conditions may also occur if an infant has a severe attack of any disease before the eruption of the teeth; a peculiar condition of the permanent teeth in which the incisors are small, conical, and notched at the edges is typical of congenital syphilis (teeth in this condition are termed *Hutchinson's teeth*). The membrane of the tongue being continuous with that of the entire alimentary tract, its condition affords an index to that of the alimentary canal; thus, when an individual is constipated or suffering with digestive disturbances or other diseases of the stomach or intestines, the tongue is coated and furred; clearing of the tongue at the edges is one of the signs of improvement in typhoid. The tongue is apt to be red and swollen in diabetes; scarred in epilepsy; punctated like a strawberry in scarlet fever; ulcerated in mercurial poisoning, stomatitis, and syphilis. Tremor of the tongue is noted in alcoholism, paretic dementia, and in diseases which result in great prostration, as typhoid. The symptom connected with the throat that it is of special importance to notice at once is the presence of patches for this is one of the diagnostic symptoms of diphtheria;

patches are also present in follicular tonsillitis and sometimes in scarlet fever.

Headache is a symptom of many abnormal conditions; examples are: Debility; anemia; toxication due to bacterial infection; defective metabolism or elimination (*e. g.* constipation) and gastric disturbances; catarrh of the nose or communicating cavities; nervousness; neuralgia; nerve-fag; eye-strain; meningitis; pressure on the brain from tumor or other cause. Headache occurring in nephritis often indicates an attack of uremia and should therefore be reported.

Abnormal conditions of hearing may arise in the course of disease and following the use of certain drugs. Deafness, partial or complete, may indicate infection of the inner or middle ear; blocking of the auditory canal or of the Eustachian tube[1]; injury to the auditory nerve, destruction of the auditory center of the brain. The diseases in which this complication is most likely to arise are: Scarlet fever, meningitis, diphtheria, typhoid. In nervous conditions the hearing is sometimes hyperacute. Ringing in the ears (tinnitus) is a symptom of overdosing by quinine and the salicylates and it frequently occurs in anemia, general debility, arteriosclerosis, and in diseases of the ear or auditory nerve.

Hiccup (singultus) results from spasm of the diaphragm and it is associated with closure of the glottis. It may be due to direct stimulation of the phrenic nerve or the result of reflexes started by irritation in the stomach, intestines, or liver. Persistent hiccup occurring in diseases of these organs is usually a bad sign. Hiccup may also occur in extreme exhaustion and hysteria.

[1] A small canal extending between the middle ear and the throat.

Pain is due to stimulation of certain sensory nerves. It differs considerably according to the nature of the stimulation. Terms commonly used to describe the nature of the sensation produced are dull, sharp, throbbing, shooting, burning, straining, collicky. The presence of pain and its nature, the measures used for its relief, and the result of these should be charted.

Palpitation is a rapid and tumultuous heart action that is perceptible to the patient. It may show abnormal heart conditions, anemia, excessive exercise; it may result from reflexes started by gastric or intestinal irritation, nervousness, excitement.

Excessive perspiration; known also as sweating and diaphoresis, is a common symptom of rheumatic fever and tuberculosis; in the former, the perspiration has an acid reaction and a sour odor; in tuberculosis it occurs periodically following an elevation of temperature. Diaphoresis is also common at the crisis of such diseases as pneumonia. If other physical conditions are favorable, diaphoresis occurring in the course of a febrile disease usually merely indicates an effort on the part of the heat regulating center to reduce the temperature, but if it is associated with a weak pulse and cold exterior of the body, it indicates excessive weakness. Diaphoresis is also induced by certain drugs[1] and nervousness. In health it will follow any condition that tends to increase body temperature.

The position a patient assumes is a symptom to be noted. When abdominal pain due to inflammation exists, the patient usually lies on her back with her knees flexed; if the pain is due to gas either this or the prone position is likely to be taken and the patient is apt to make pressure, or ask for pressure or heat, upon

[1] How are such drugs classified?

the abdomen. When dyspnea is severe, a sitting position is usually requested. In disease which involves one lung, the patient, if not sitting, will usually lie on the affected side, to give the normal lung more freedom. In diseases and poisoning which stimulate the spinal cord the head is likely to be bent backward and the back stiffened as the result of contraction of the muscles of the neck and back. In diseases of the spine and cord, the position known as *Kernig's sign* is common; *i. e.*, the patient lies with the thighs flexed at right angles with the pelvis and it is impossible to straighten the leg completely while the patient is recumbent.

Tenesmus, ineffectual and painful straining at stool or in urination, usually indicates intense irritation in the organs involved.

Tremor or subsultus is an involuntary trembling of the body. It is characteristic of alcoholism and of excessive weakness.

Tympanites may be defined as abdominal distention due to the collection of gas in the intestines or in the peritoneal cavity. The intestines may become distended with gas as the result of excessive putrefaction of the intestinal contents, intestinal obstruction, intestinal paralysis. Tympanites due to gas in the peritoneal cavity is a symptom of peritonitis and of intestinal perforation. Tympanites is not only a serious symptom, but a serious condition for it may interfere with the functioning of both abdominal and thoracic organs. Any appearance of abdominal distention is therefore to be reported as soon as observed and is to be especially watched for after abdominal operations, in typhoid fever, and pneumonia.

Vomiting or emesis is the forcible expulsion of the stomach contents through the mouth. It is induced by

stimulation of the vomiting-center[1] which is situated in the medulla oblongata. This center is so intimately connected with other centers that it may be stimulated by impulses coming from many sources; examples are: Irritation of the stomach or intestines; severe pain in any part of the body; abnormal conditions of the liver, kidneys, uterus, ovaries, eyes; subjection to unnatural movements, as when at sea, swinging, etc.; interference with the cerebral circulation; pressure on the brain; substances in the blood, such as the toxins of bacteria and those due to intestinal putrefaction; defective metabolism and imperfect elimination; drugs which stimulate the center. The two causes last mentioned are classed as central stimuli while an irritation originating in a distant part of the body is known as a reflex stimulus or irritation.

Anything unusual in the manner of vomiting is to be noted; *e.g.* (1) if the vomitus is ejected with force (projectile vomiting)—this frequently occurs when the vomiting is due to a central stimulus; (2) if, contrary to the usual rule, vomiting is not associated with retching and nausea, this frequently has the same significance as, and is associated with, projectile vomiting, but it is also the nature of what is known as *esophageal vomiting* or *regurgitation of food* which is generally due to either obstruction in the esophagus, paralysis of the muscles of deglutition, or, especially in the case of infants, the ingestion of more food at a time than the stomach will hold. Also, it is to be observed if vomiting is associated with pain and, when it is, if the pain is relieved by the vomiting.

[1] To what muscles does this center send impulses in order to promote vomiting? If unable to answer see a textbook of Physiology.

There are three conditions the symptoms of which should be recognized by nurses at once; viz., hemorrhage, shock or collapse,[1] and inflammation.

The symptoms of hemorrhage are pallor, restlessness, air-hunger, rapid shallow breathing, increase in rate, and decrease in the volume, of the pulse, fall of temperature, and, if the wound is external, blood will be seen.

The symptoms of shock are similar to those of hemorrhage, except that there is no escape of blood from the body and the pallor is of a bluish cast, due to the blood settling in the small veins.

The causes of the symptoms, and the reasons why those of the two conditions are similar, were stated in Chapter V.

The symptoms of inflammation will be found in the section on infected wounds, Chapter XVII.

Conditions to Observe in Discharges and Excreta

Sputum

Sputum proper consists of saliva and mucus which, due to irritation or other abnormal stimulus, are secreted in larger amounts than usual. Sputum may however be mixed with blood or pus and the mucus, instead of being a thin, almost watery fluid, may become thick and very tenacious so that it will be expectorated with difficulty. As changes in the nature of sputum are due to the conditions causing them, the

[1] The symptoms and, as far as can be judged, the condition are the same in collapse as in shock, the term collapse being used when the condition occurs in the course of an illness and shock when it is the result of traumatism and causes other than illness.

sputum is of great diagnostic value in diseases of the respiratory organs and it must be always carefully observed. The more common types of sputum are as follows: **Mucoid sputum** (*i.e.*, mucous-like) is commonly associated with irritation such as is present with a cold, in asthma, the early stages of bronchitis, pneumonia, and tuberculosis. **Muco-purulent sputum** contains pus, as well as mucus, and it is thicker and more tenacious than the mucoid type. It is present in the later stages of bronchitis; in bronchiectasis; in pneumonia, after the crisis; in the later stages of tuberculosis; and in abscess of the lung or some part of the pharynx or communicating sinuses. **Purulent sputum,** which consists of almost pure pus, usually indicates the rupture of an abscess in some part of the respiratory system. **Blood in the sputum** occurs chiefly in the later stages of pneumonia, tuberculosis, cancer, and gangrene of the lung. In pneumonia the amount of blood in the sputum generally increases with the severity of the inflammatory process. If pulmonary vessels are ruptured the material coughed up may be solely blood mixed with air, which gives it a frothy appearance.[1] This occurs most frequently in tuberculosis, and as the result of puncture of a lung, as by a fractured rib. **Rusty sputum** is the name given to the blood-streaked sputum that occurs in pneumonia. **Prune-juice sputum** is sputum containing blood that has been so altered by disintegration during retention in the lung that it resembles prune juice. It occurs in severe cases of pneumonia and in cancer and in gangrene. **Nummular sputum** is the term applied to

[1] Because of this, blood from the lungs (hemoptysis) can always be distinguished from that from other parts of the respiratory tract and the stomach.

round coin-shaped masses of sputum which sink in water; it is seen chiefly in advanced tuberculosis. **Fetid sputum** is so called from its offensive odor; purulent and prune-juice sputums are particularly likely to have this characteristic. The sputum of individuals who work in coal mines and in factories in which dust-producing industries are carried on is likely to be of a grayish color or almost black and the dust may cause sufficient irritation and congestion to induce sputum without the presence of other abnormal condition. These conditions are also likely to exist in *mouth-breathers* because air, entering through the mouth, is not filtered, as it is when it passes through the nasal passages.

Vomitus

The more common conditions of vomitus other than that consisting mainly of undigested food are: **Bilious or green vomiting**; this is likely to be seen whenever vomiting persists after the stomach has been emptied of food. The color is due to bile which is forced from the intestines into the stomach. **Dark brownish-green vomitus** with an intensely acid reaction is noted in peritonitis. **Blood in the vomitus** may be the result of abrasion of the mouth, pharynx, or esophagus; and vomited blood, *i. e.*, that ejected from the stomach, may have been swallowed, otherwise it is generally due either to traumatism, gastric ulcer, carcinoma, severe gastritis, abrasion of the stomach by corrosive poisons, severe infections or poisons that cause changes in the permeability of the blood-vessel walls or the composition of the blood, or to vicarious menstruation. Blood may be vomited in such quantities that the conditions

of hemorrhage will ensue (this is known as *hematemesis*) or it may be in such small amounts that its presence will be detected only with the help of a microscope or spectroscope or by chemical tests; this is known as *occult* (hidden) *blood*. If blood remains in the stomach after it is shed it is likely to be digested and assume the condition described as coffee-grounds, and is known as "**coffee-ground vomitus.**" **Fecal or stercoraceous vomitus** is usually due to either intestinal obstruction or a gastro-intestinal fistula. **Mucus in the vomitus,** except in very small amounts, indicates irritation of the gastric mucosa; it is seen more especially in chronic gastritis. **Purulent vomitus,** *i. e.*, that containing pus, generally indicates either the rupture of an abscess or severe gastritis. **Profuse vomiting of fermented frothing matter** is indicative of gastric dilation which prevents the stomach being emptied in a normal manner and furthers the excessive accumulation of food. Such a condition is often due to carcinoma of the pylorus.

Feces

The character of feces being an index of the condition and functioning capacity of the digestive organs, all evacuations of the sick and of infants should be carefully examined. This should be done in a good light and, when there is any special reason for examination, the feces should be broken or stirred with a spatula for it is often difficult to detect foreign matter.

The principal items in connection with stools to be observed are: The number of movements in the twenty-four hours, the consistency of the stools, their shape, color, and odor, the presence of any foreign matter.

The appearance of normal stools varies somewhat according to the diet, but the stools of an adult on an ordinary mixed diet usually consist of a light to dark brown, soft mass of cylindrical shape or, if food with little residue is eaten, partly formless. The normal stools of a breast-fed infant are soft, with homogeneous consistency, they have a yellow or orange tint and an acid reaction. Those of an infant fed with cow's milk are lighter in color and bulkier. The normal evacuation of the new-born infant is an odorless, sticky, thick, brown liquid known as *meconium*.

The usual number of stools for adults are one or two a day, for babies fed with human milk, three to six a day, babies fed artificially, usually, have fewer, but larger evacuations.

Change in the frequency of defecation is usually due to either irritation or constipation. In the former condition the change is an increase; in the latter, it is generally a decrease, but, occasionally, especially when the condition is due to lack of intestinal tone, it may be an increase, because of inability of the rectum to empty itself properly; in such case the consistency of the stool will indicate constipation. Intestinal irritation may be due to medication, undigested food, or diseased conditions of the intestine. Constipation is most commonly due to a diet deficient in food with undigestible elements, or to a lack of tone in the intestinal and abdominal muscles, or to impairment of the sensitiveness of the rectum so that it is not effectually stimulated by its contents,[1] or to an over-contracted sphincter or obstructive lesions caused by intestinal disease.

Change in the consistency of stools is generally due

[1] This results from frequent failure to respond to such stimulus.

to the same conditions that cause change in their number, because water is absorbed chiefly from the large intestine and, therefore, the longer material remains there the harder it will become, thus the constipated stool is a hard one. On the contrary, if matter is hurried through the intestine the stool will be soft or, when the irritation is so severe that the rate is greatly accelerated, watery. Saline cathartics and certain diseases, as cholera and severe diarrheas, still further increase the fluidity of stools by promoting the transudation of water from the body, and salines, in addition, by preventing the absorption of the water in which they were dissolved previous to ingestion.

Change in the shape of stools other than that due to consistency, usually results from pressure upon, or stricture in, the intestine. Such conditions may cause the stools to be of unusually small diameter or flat.

The more common changes that occur in the color of stools are: Black stools; this color may be due to the use of such drugs as bismuth, charcoal, iron, or tannin, or to the presence of blood that has been retained in the intestine for some time and while there altered by the digestive juices. Red discoloration of the feces, unless the patient is getting hematoxylon (logwood), usually indicates the presence of freshly shed blood. Green stools may result from the presence of bile in unusually large proportion, or excessive intestinal putrefaction, or intestinal disease. Greenish-yellow stools of a thick liquid consistency are characteristic of typhoid. Gray stools indicate a lack of bile in the intestine; they are often seen when the patient is jaundiced for, in such case, the bile is being absorbed by the blood instead of being discharged into the intestine.

A foamy, bubbling appearance of infants' stools usually indicates too much sugar in the diet.

The more common causes for change of odor of feces are: Lack of bile, excessive intestinal putrefaction, diseased conditions of the intestine.

The foreign substances most commonly found in stools are: Blood, mucus, pus, undigested food, gall-stones, worms.

Blood in the stools may be the result of inflammation, as in enteritis; of acute congestion resulting from continued purging, or interference with the venous circulation, as in chronic heart disease; of ulceration of the intestinal wall or corrosion by poisons; of cancer; of conditions which affect the composition of the blood or state of the capillary walls, as scurvy and purpura; of traumatism; of piles or fistula; or it may be from the stomach or other part of the alimentary canal. When the patient is a woman it may be necessary to ascertain if the blood is from the genital or urinary tract. The color of the blood and its location in the feces may indicate its source, for blood that comes from the upper part of the alimentary tract, unless it is passed at once, will be dark, even tarry-like, and it will be mixed with the feces, but blood coming from the lower part of the bowel will be bright red and the nearer its

[1] By intestinal putrefaction is meant the decomposition of protein matter in the intestine by bacteria. Such cleavage gives rise to substances such as indol and skatol which are absorbed by the blood and, if present in any amount, will cause headache and other indispositions. These substances are changed in the liver to less toxic matter, such as indican, and excreted in the urine. Conditions which favor excessive intestinal putrefaction are: The presence of large amounts of protein in the intestine, constipation, and intestinal disturbances which interfere with the proper digestion and absorption of food.

source is to the rectum the less will it be mixed with the feces; that due to piles and rectal fistula is usually all on the surface and the stool is otherwise normal and free from excess mucus. Blood may be in the feces in such minute amounts that it is designated *occult blood* (see page 563), or in such large quantities that it is a hemorrhage. Hemorrhage from the intestines is termed *enterorrhagia.*

Mucus is present in feces in minute amounts under normal conditions because it is secreted by mucous cells to lubricate the membrane and much of the secretion becomes mixed with the feces. When, however, the intestinal mucosa is excessively irritated its cells become over-active and unusual amounts of mucus are secreted. Thus, any condition causing unusual intestinal irritation is likely to be associated with excess mucus in the stools in amounts that will be parallel with the degree of irritation. When the irritation is in the small intestine or upper part of the large intestine, the mucus is mixed with the stools; when it is in the lower part of the bowel it is chiefly or entirely on the surface.

Pus in the feces may be due to severe intestinal inflammation or to the rupture of an abscess in, or into, the intestines. Unless pus is present in large amounts chemical tests or microscopical examination may be necessary to detect it.

Stools which contain much undigested food are known as *lienteric stools;* they are noted in conditions of the stomach and intestine which interfere with digestion. Food substances that are more or less undigested may also be seen in feces if too large a quantity of any one particular food, or of food as a whole, is eaten. Imperfectly digested fat will also be

seen in defecations when there is a lack of bile in the intestine, and in disease of the pancreas; its presence may be indicated by a loose, greasy, sour-smelling movement or it may be seen as small yellow masses or flakes. Similar but harder masses, that are white inside, will be seen in an infant's stools when it is given too much protein. An easy way to distinguish between masses of fat and protein is to put the material into a little ether—fat will be dissolved, protein will not be.

Gall-stones are formed chiefly in the gall bladder, but also in the biliary ducts. Their usual cause is a catarrhal inflammation which leads to the precipitation of solid matter of the bile, especially bilirubin-calcium. The passage of a large stone is associated with intense pain, but this is not necessarily the case with small ones and, as a rule, it is small ones that have to be watched for when cholelithiasis is suspected, but has not been diagnosed. They vary greatly in size and shape, but are usually either white or of a brownish shade. A method of examining defecations for calculi was described in Chapter VII.

The worms most frequently found in feces are: The thread- or seat-worm, a fine white worm one fifth to two thirds of an inch in length; the round or eel-worm, which is of a grayish or pinkish color and in form resembles earthworms; the hookworm which measures from 8 to 18 mm. in length; the tapeworm: the type common in this country is the *tænia saginata* with which man becomes infected by eating infected beef; the mature worm is from five to ten yards in length, it is usually flat, and pieces of it may be mistaken for shreds of thickened mucus. When a tapeworm is expelled it must be kept for the physician's

examination for it is most important to ascertain if the head is present, since, if it is not expelled, the worm can grow again. The head is very minute and that of the beef tapeworm has no hooklets like that of the pork tapeworm.

Urine

Normal human urine is a clear yellow liquid, of weakly acid reaction, with an average specific gravity of 1020, the usual limits in health being 1015 to 1025. The average quantity voided per day by a healthy adult is between forty and fifty ounces; by a child between nine and fourteen years, thirty-five to forty ounces; between five to nine years, twenty-five to thirty-five ounces; two to five years, fifteen to twenty-five ounces.

Urine consists chiefly of water, holding in solution nitrogenous substances—principally urea, ammonia compounds, salts of uric acid (urates), creatinin, and similar substances—inorganic salts, pigments which give it color, etherol substances to which its odor is due.

These substances are derived from the blood and represent (1) material that has been formed by the catabolism of substances of the body cells; (2) matter absorbed from the intestine and not used for tissue building; this may or may not have undergone change after absorption, for some substances, *e. g.*, meat extractives, cannot be used by the body either for tissue building or fuel. Also there may be, even in health, other substances present derived from unusual articles of food or drugs that have been taken.

The proportion of the urine constituents will vary somewhat in health according to the quantity and

kind of food eaten, the amount of exercise taken, and other factors that influence metabolism.[1] But any considerable variation in either the quantity or nature of the urine constituents that cannot be accounted for in these ways usually means either disturbed metabolism, defective kidney conditions, defective intestinal conditions which provide abnormal substances for absorption, or abnormal conditions of the liver.

Changes in the urine constituents that may indicate defective metabolism are[2]:

A decrease in the amount of urea with proportionate increase of ammonia compounds. This indicates defective protein metabolism because ammonia compounds are precursors of urea in protein metabolism.

Decrease in the amount of urates is seen preceding an attack of gout; the cause is unknown. Urates are salts of uric acid, which is derived from nucleo-protein, *i. e.*, the protein in the nuclei of cells.

The persistent presence of glucose indicates defective metabolism of glucose.

The presence of acetone and diacetic acid indicate defective metabolism of fats.

Substances which if present in the urine usually point to disease of one or more of the urinary organs are:

Albumin. This, however, is sometimes present in the urine without disease of the kidneys, as the result of conditions that affect the blood pressure in the

[1] What are the principal factors controlling metabolism? If unable to answer see the section on Metabolism in either a textbook of Physiology or Dietetics.

[2] For the conditions producing such defects see textbook of Dietetics or the section on Nutritional Diseases in a textbook devoted to description of disease.

renal vessels and in nervous and febrile diseases and those which cause extensive change in the condition of the blood, but persistent albuminuria usually indicates either actual nephritis or a severe congestion of the kidneys, such as that occurring in certain diseases of the heart and liver.

A decrease in the amount of urea and other protein cleavage products and of salts in the urine usually accompanies persistent albuminuria, for, under normal conditions, the extraction of solid matter from the blood by kidney cells is a process of secretion or selection, and material which the body does not want is taken and that which it does require, as albumin, is not extracted, but, when the secretory cells of the kidney tubules are diseased, their functioning is likely to be impaired.

Mucus may be in the urine as the result of irritation of any part of the urinary tract.

Pus in the urine (*pyuria*) indicates suppurative inflammation in some part of the urinary tract or the rupture of an abscess into the tract.

Blood in the urine (*hematuria*) is generally the result of traumatism, corrosion, or severe inflammation in some part of the urinary tract; or of calculi; or of conditions which affect the coagulable property of the blood or the permeability of the blood-vessels.

Renal calculi are concretions that have formed in the kidney by the deposition of crystalline material from the urine, around a definite nucleus. The latter usually consists of organic matter, such as blood, mucus, desquamated epithelial cells. Such concretions vary in size from the consistency of a coarse sand (usually termed gravel) to the size of a large bean. Several stones may be present at a time. Calculi grow

by accretion, *i. e.*, the deposition of successive layers around a nucleus and, usually, the matter deposited is all of one kind so that there may be uric acid calculi, calcium carbonate calculi, phosphate calculi, etc. Calculi may form also in the bladder, they are known then as *vesicle calculi*. The reason for such depositions is not known.

Casts consist of coagulated material that has hardened in the urinary tubules. They are so-called because, when washed from the tubules by the urine, they retain the shape, and are thus a cast, of the tubules. The origin of the material deposited is not definitely known, but it is thought to be derived either from degeneration of renal cells, or a secretion of diseased cells, or a transudate from the blood. Casts vary in appearance, some being transparent and homogeneous in consistency; such are known as *hyaline casts;* others are full of granules and are termed *granular casts*, others contain fat, others blood, others pus, others epithelial cells and they are named according to their content. A few hyaline casts will frequently be found in normal urine, a rise of blood pressure from even normal causes being sufficient to produce them, but all of the other types indicate abnormal kidney conditions. All casts are of microscopic size.

Epithelial cells from the walls of the genito-urinary tract, if more than a very few are present, denote inflammatory or destructive lesion in some part of the tract.

Indican is the principal foreign substance found in the urine as the result of defective intestinal conditions; its source was mentioned on page 566. It may be present in the urine in very small amounts under normal conditions but, the presence of more than a

trace indicates excessive intestinal putrefaction and it is likely to be associated with feelings of general malaise due to the auto-intoxication.

Bile will appear in the urine if its elimination is interfered with, for it is then absorbed by the blood. Common causes of obstruction are: The presence of foreign substances (*e. g.*, gallstones) in the gall bladder or biliary ducts; pressure on the ducts by tumors; stricture of the ducts; inflammatory conditions of the duodenum which occludes the common duct; catarrhal inflammation of the minute bile ducts excited by toxic substances circulating in the blood.

With the exception of gravel and calculi, the presence of the substances mentioned in the preceding pages can only be accurately determined by chemical or microscopical examination, and nurses, except in special cases, are not expected to discover them, but they are expected to notice anything unusual in the urine and, when this exists, unless it can be accounted for, save a specimen for examination; for, though visible changes are sometimes the result of physiological processes, they are also likely to be due to the presence of foreign matter or to abnormal processes.

The points that nurses are especially to observe are: The quantity, color, transparency, and odor.

Polyuria, *i. e.*, an increased flow of urine, is most commonly due to: Excessive intake of fluids; the use of diuretics; diminution of perspiration; neurotic conditions; diabetes mellitus; diabetes insipidus, chronic interstitial nephritis.

Oliguria, or diminution of secretion, most commonly occurs: When the intake of fluids is limited; when the loss of water is increased through other channels, as in diarrhea, profuse perspiration, continued vomiting;

in fever; in conditions which interfere with the renal circulation, as in valvular heart diseases; in most types of nephritis.

Anuria, or suppression of urine, is likely to occur: When the nephritis is severe, and in collapse from any cause.

Retention[1] of urine is most commonly due to nervousness; obstruction in, or paralysis of, the urethra or bladder; or dulling of the senses so that there is no stimulus excited. In all of these circumstances there may be a constant passage of small amounts of urine, but the bladder fails to empty itself; this is known as *retention with overflow.*

Change in the color of urine will be observed with variations in quantity for, naturally, a urine is darker when it is concentrated than when it is dilute. In diabetes mellitus, though there is an abnormally large amount of urine passed, the color is deeper than normal because of the presence of sugar which makes the urine more concentrated than usual, and thus not only heightens the color but causes a higher specific gravity.[2] Other causes of change of color are: The presence of such foreign substances as blood, which causes either a red or a smoky hue; bile, which imparts a brownish shade; mucus, pus, and chyle[3] which cause a

[1] When the kidneys fail to secrete urine the condition is called *suppression* or *anuria;* when the urine is secreted, but not passed from the bladder, it is termed *retention.*

[2] What does the specific gravity of a liquid represent? How is the specific gravity of liquids usually ascertained? What law of physics is demonstrated in the use of the urinometer? If unable to answer these questions see textbook of Physics.

[3] Chyle is seen in the urine (chyluria) in the condition known as *filariasis*, an infection due to a parasite called the *filaria bancrofti,* which causes obstruction in lymph glands.

whitish cast; excessive amount of urates will give a red discoloration, and large doses of certain drugs, especially carbolic, and its allies, senna, rhubarb, logwood, and methylene blue give characteristic colors.

The transparency of urine is lessened by conditions which affect its color.

The odor of normal urine becomes ammoniacal if it is allowed to stand long after being voided, owing to chemical changes in its proteins, but if this odor is present when urine is passed it shows that such changes have taken place in the bladder and this usually indicates cystitis. Certain drugs, especially sandlewood, turpentine, cubebs, and copaiba and also asparagus impart characteristic odors.

Vital Function Tests

A vital function test, as the name implies, is a test used to determine if the functional capacity of a vital organ is normal or defective. The purposes of some of the more commonly used ones and the procedure in the portion of the work that the nurses are concerned with are as follows:

The phenolsulphonaphthalein test is one of the most commonly used tests to determine the functional capacity of the kidneys. Its use is based on the fact that the drug is eliminated entirely by the kidneys and, if it is injected subcutaneously,[1] it will, if the kidneys are functioning properly, appear in the urine in five to ten minutes after injection, and about 60% of the amount injected will be recovered at the end of one hour and practically the entire amount at the expiration of two

[1] If the drug is given by mouth it does not appear in the urine until from one to one and a half hours after injection.

hours. If the kidneys are not functioning properly, excretion is delayed in proportion to their disability.

The usual technique is as follows: Twenty to thirty minutes before the injection of the drug, the patient is given 300 to 400 c.c. of water to insure diuresis. The bladder is catheterized and the catheter left *in place* and, noting the time, the drug is injected into the lumbar muscles. The free end of the catheter is inserted in a test tube containing one drop of 25% sodium hydroxid and this is watched until the urine which drops into it becomes pink on contact with the sodium; this shows the presence of the drug in the urine. The time that this occurs is recorded and, unless there is some urinary obstruction, the catheter is withdrawn. The patient is to void urine or, if this is impossible, be catheterized in one hour and, again, two hours after the injection of the drug. The urine obtained at the different times is put into separate bottles appropriately labeled and sent to the laboratory. The time at which each specimen was voided and the length of time that elapsed before a pink color was observed in the test tube should be stated on the labels.

If, for any reason, the catheter is left in the bladder, the free end is clamped as soon as the pink color is noted in the test tube. The clamp is opened at the termination of an hour, closed as soon as the bladder is emptied, opened at the end of the second hour and, after the bladder is emptied, withdrawn.

In the laboratory the urine is tested to ascertain how much of the drug has been recovered.

Roche's methylene blue test to determine disturb-

ance of the antitoxic function of the liver[1] consists in giving the patient a capsule containing .002 gm. of methylene blue in the morning, when the stomach is empty, and collecting the urine that is passed during the next eight hours. That voided during each four hours is put into separate bottles and saved for the physician's inspection. If the liver is not functioning properly, the urine, especially that passed between four to eight hours after the administration of the drug, will be colored green. If the liver is normal, this will not be the case because this amount of methylene blue will be completely arrested by normal liver cells.

A test for the absorptive power of the stomach is as follows: The patient is given a capsule[2] containing 0.1 gm. of KI and the time recorded. In ten minutes, the patient is asked to spit some saliva on a piece of starch paper and a drop of fuming nitric acid is added to this. If conditions are normal some of the KI will have been absorbed and will be in the saliva, and the nitric acid will liberate the iodine in the KI from the potassium and the iodine will combine with the starch to form a blue iodide of starch. If the color does not appear, or is very faint, get samples and test them in the same way every ten minutes.

There are several tests to determine the motor and secretory capacities of the stomach which consist in giving the patient certain foods,[3] the average time for

[1] One of the important functions of the liver is to modify poisons formed in the body, especially those reaching it through the portal vein. Where is the portal vein and what difference is there in the blood that it contains and that in other vessels?

[2] Care must be taken not to have any KI on the outside of the capsule.

[3] The purpose in using certain foods is to allow of comparison of results with different patients.

the digestion of which is known, and, later, at specified times, removing the residue, as described in Chapter IX, and examining it quantitatively and by chemical tests. The motility of the stomach will be estimated by the amount of residue recovered, its secretory capacity by the change that the protein[1] has undergone and the amount and nature of the acid present. Knowledge of the acidity of the gastric contents is often of great help in diagnosing gastric conditions because hyperacidity or hyperchlorhydria is characteristic of some abnormal conditions and subacidity or hypochylia, of others. Gastric ulcer is one of the most important conditions in which hyperacidity is usual and subacidity or acidity due to lactic acid, produced by fermentation of foodstuffs, is common in gastric cancer.

The following are the gastric test meals most frequently used:

Ewald test meal consists of a roll or piece of bread or toast, in amount 35 grams, without butter, and two cups (amounting to 400 c.c.) of tea or water without milk or sugar. Tea is not used if the residue is to be examined for blood as the tannic acid in the tea interferes with the blood tests. The gastric contents are withdrawn one hour after the meal is completed and normally the residue will measure between 30 c.c. and 50 c.c.

Fisher test meal is the same as the Ewald, plus a quarter of a pound of finely chopped lean meat broiled and seasoned. The residue is removed at the end of three hours.

[1] It will be remembered that the stomach only furnishes enzymes to help with the digestion of proteins and emulsified fats, such as that of cream.

Boas test meal consists of six ounces of oatmeal gruel for the making of which one tablespoonful of oatmeal was used. The residue is removed one hour after the gruel is eaten.

Riegel test meal consists of 400 c.c. of soup, 200 grams of beefsteak, and either two slices of bread or 150 grams of mashed potato, and a glass of water. The residue is removed in between three and four hours.

The Ewald, Fisher, and Boas meals are given as breakfast and the Riegel meal, as a rule, in the middle of the day.

The Schmidt intestinal test diet is used for ascertaining the digestive functional capacity of the intestine and pancreas. It will be remembered that the pancreatic juice, which contains the enzymes required to promote the digestion of all classes of foodstuffs, is emptied into the intestine and thus intestinal digestion is as dependent upon proper pancreatic functioning as intestinal.

The daily diet, while the test is in progress, consists of 1.5 liters of milk; 100 gm. of zwieback; two eggs; 50 gm. of butter; 125 gm. of chopped beef (raw weight) broiled rare; 190 gm. cooked potato; oatmeal gruel made with 80 gm. of oatmeal. This is distributed through the day as may best suit the patient. All feces passed is saved and sent to the laboratory, where chemical tests are made to ascertain the degree to which the digestion of the different food constituents have been carried.

The Folin diet is used in estimating the state of metabolism; it is continued for several days and while it is in use *all the feces and urine passed* are sent to the laboratory. It consists of milk, 500 c.c.; cream (18%

to 22% fat), 300 c.c.; eggs, 450 gm.; Horlick's malted milk, 200 gm.; sugar, 20 gm.; sodium chlorid, 6 gm.; water 2100 c.c. The food is distributed through the day as best suits the patient's requirements.

The Use of Vaccines in Diagnosis

Vaccines are sometimes used as an aid in diagnosing certain diseases, especially tuberculosis and syphilis. Their use is based on the fact that normal individuals do not show reaction so quickly nor so intensely to small doses of vaccine as do infected individuals, for they have sufficient antibodies in their blood to overcome the effects of amounts of toxin that will produce reaction in a person whose blood already contains toxins due to infection.

Tuberculin vaccine is given in several ways, viz.:

Method of Koch: For at least 24 hours previous to the test, the patient's temperature is taken every three hours. The tuberculin is injected into the deeper tissues, as described in Chapter, XV. in usually either the intrascapular or gluteal region. Following the injection, the patient's temperature is taken every two hours for the length of time prescribed. A rise of temperature, even ½°C. (9/10°F.) within a few hours is considered strong evidence that the patient has tuberculosis, but a negative result is thought to be a less reliable indication of immunity, for, in some tubercular processes, the virus may be so encapsulated that reaction does not occur. If a relatively large dose of tuberculin is used the patient, if tubercular, may have chills, fever, and general malaise.

Method of Moro. A salve containing tuberculin is rubbed into the skin (see inunction, page 447), prefer-

ably in the thoracic or abdominal region. If the patient is tubercular, small nodules usually appear on the area of application after about twenty-four to forty-eight hours.

Method of Pirquet. The inner side of the arm is cleansed with alcohol and ether and allowed to dry. Two drops of tuberculin are placed in this cleansed area, about two inches apart, and the skin under each drop is scarified with a large sterile needle and the solution rubbed in with the needle and allowed to dry. A positive reaction is indicated if papules appear within forty-eight hours.

Method of Calmette. The eyelids are held apart and a drop or two of diluted tuberculin dropped in the conjunctival sac, as described on page 423. If the patient has tuberculosis, a conjunctivitis will usually occur within six to twenty-four hours.

Luetin Test for Syphilis. A vaccine, known as *luetin*, is injected into the skin of the upper arm. Even in normal persons a slight erythema may appear, in about twenty-four hours, around the site of injection, but a positive reaction is indicated if the eruption consists of papules or pustules.

These vaccines, except that in salve, are usually given by a doctor but nurses should understand the tests as they must watch for the reactions.

Examination of the Blood

The more common reasons for examination of blood are to ascertain (1) if bacteria or their products are present; (2) the number and condition of red cells; (3) the amount of hemoglobin; (4) the number of white cells.

The examination of the blood for the purpose first mentioned is made by taking a small amount from the patient and, usually, either examining it under the microscope or adding a serum to it that will give some specific reaction if the patient has the disease for which the test is made. Common tests of this nature are the Widal for typhoid and the Wassermann for syphilis. As these tests are performed by the laboratory technologists, they will not be discussed here; description of them will be found in text-books of Bacteriology.

The hemoglobin is contained in the red cells and the latter depend upon it for their power of functioning, *i.e.*, absorbing oxygen and carrying it to the tissues, and, as the amount of oxygen that can be absorbed depends largely upon the quantity of hemoglobin, any marked deficiency of this substance will reduce the body's supply of oxygen and interfere with nutrition.

In normal blood there are approximately 5,000,000 red corpuscles per cm. of blood and 14.5 gm. of hemoglobin per hundred c.c. of blood, which amount, because it is the average normal quantity, is known as 100%.

The number of red cells is temporarily slightly diminished during menstruation, gestation, lactation, in fatigue and slight indispositions, and loss of blood and protracted illness may cause such a loss or destruction of red cells that the condition known as *secondary anemia* occurs and, in certain abnormal conditions that are but imperfectly understood, there is a permanent low percentage of red cells; this is termed *primary anemia*.

Living in high altitudes increases the number of red cells in the blood and thus prevents ill effects from the

differences in the respiration that are caused by the reduced atmospheric pressure.[1]

As the hemoglobin is contained in the red cells variations in its amount are, ordinarily, within fairly close limits, in keeping with changes in the number of cells, but, occasionally, this is not the case. The relation between the number of cells and amount of hemoglobin is referred to as the *color index*, and when the proportion of hemoglobin is high in relation to the number of cells the color index is said *to be high*, even though the hemoglobin is lower than normal. When contrary conditions exist the color index is said *to be low*. Under normal conditions, the red cells lose their nucleus before they enter the circulating blood from the bone marrow, but in severe anemias nucleated cells and cells differing from the normal in size and shape are likely to be found in the blood.

The average number of white cells is, normally, between five thousand and ten thousand. These cells, as seen under the microscope, show certain differences and they are acted upon in different ways by dyes. They are classified according to these variations.[2] A common classification and the approximate percentage of each kind usually found in blood under normal conditions are about as follows:

Polymorphonuclears, 65% to 75%; large mononuclears, 3% to 5%; eosinophiles, 1% to 4%; basophiles, 0.5%; large lymphocytes, 1%; small lymphocytes, 20% to 25%.

[1] Space will not permit of description of the physiologic factors which occasion this compensation but a very interesting account will be found in *Organism and Environment*, Haldane, Yale University Press.

[2] The nomenclature used for these cells varies. The above was taken from *Manual of Physiology*, Stewart, Wm. Wood & Co.

Change in the number of leucocytes as a whole and in their relative proportion is characteristic of many diseases and thus knowledge of such change is of great diagnostic value.

When the number of white cells as a whole is counted, it is called an *absolute count*, when the different kinds of cells are counted, it is known as a *differential count*. When the absolute count is above ten thousand, the condition is spoken of as a *leucocytosis;* when the count is below five thousand, the condition is called a *leucopenia*.

Leucopenia is seen in some infections that do not cause leucocytosis, notably: typhoid fever, tuberculosis, measles, and malaria, and in pernicious anemia and inanition.

Leucocytosis occurs chiefly in leukemia and in inflammations and the majority of infectious diseases, except when the resistance of the individual is below par. In inflammations and the majority of infectious diseases, the polynuclears are especially increased, but unless there is also an increase of the other cells a lack of body resistance is indicated. Thus, the higher the percentage of polynuclears, the more severe the infection; the higher the absolute count, under such conditions, the greater the patient's power of resistance. For example:

If the absolute count is:	*The percentage of polynuclears:*	*The indications are:*
35,000	95	The infection is severe, but power of resistance is good.
30,000	80	Fairly severe infection, but resistance very good.
7,000	95	Severe infection, condition grave.
7,000	65	No infection.

Eosinophilia, or an increase in the number of eosinophiles, is seen in asthma and in infections due to certain animal parasites such as the trichina and worms.

Lymphocytosis, or increase in the number of large lymphocytes, occurs in typhoid fever, malaria, and lymphatic leukemia.

Demonstration 90

Making Throat Cultures

Requisites: A tube containing a sterile swab and a tube containing culture medium[1] for each pupil, a tongue depressor[2] and bag for its reception after use. The pupils should act as subjects.

The preparation of most cultures is done by doctors, or by nurses specially trained for laboratory work, but any nurse is likely to be asked, and is expected to know how, to prepare a throat culture.

Three particularly important points to remember when doing so are: (1) That the culture will be valueless if it becomes contaminated with organisms other than those in the throat, and, therefore, everything used must be sterile and kept sterile. (2) Dried up or liquefied serum is not to be used. (3) When a throat culture is required, an infection, frequently diphtheria, is suspected and thus the swab used to secure the culture and tongue depressor are likely to infect anything with which they come in contact and, possibly, with a very serious virus.

[1] This is usually blood-serum solidified with gelatin or agar agar.

[2] This is not often needed but it is always better to have it at hand.

The following directions are copied from a pamphlet provided by the New York City Department of Health:

"Place the patient in a good light and, if a child, hold it.[1] In cases where it is possible to get a good view of the throat, depress the tongue and rub the cotton swab gently, but freely, against any visible exudate, revolving the stem of the swab between the fingers, so as to bring all portions of the cotton in contact with the mucous membrane or exudate. In other cases, including those in which the exudate is confined to the larynx, pass the swab back as far as possible; avoid touching the tongue with the cotton, and rub the latter freely, in the manner just described, against the mucous membrane of the pharynx and tonsils. Withdraw the cotton plug from the culture tube, holding it so that the portion withdrawn from the tube will not come in contact with the fingers or any other substance.[2] Insert the swab and rub it gently, but thoroughly, back and forth over the entire surface of the serum. At least half a minute should be given to this operation, the stem being revolved so as to bring all portions of the cotton of the swab in contact with the surface of the serum, but do not push the swab into the serum nor break the surface of the latter in any way. Then replace the swab in its own tube. Plug both tubes. Mark the culture tube with the name of the patient, etc. The method of marking tubes, etc., for identification, was described in Chapter VII.

[1] If the child is small it should be restrained as described in Chapter VII.

[2] Take hold of the portion of the swab protruding from the tube between the third and fourth fingers of the right hand in such manner that, when the plug is withdrawn, the part that was in the tube will project behind the fingers; hold it thus until you reinsert it.

GLOSSARY

Accretion, growth by external additions.
Anaërobic, the power of thriving without air.
Anthelmintic, an agent that will destroy worms.
Antibacterial, antagonistic to bacteria.
Apposition, fitted or fitting together.
Aquatic, growing or living in water.
Arterioles, small arteries.
Astringent, a substance that will cause contraction of tissues and check secretions.
Atrophy, wasting of the tissues of a part.
Auditory, pertaining to hearing.
Autogenous, originating within the body. Self-generated.

Catabolism or **Katabolism**, the destructive processes of metabolism.
Catamenia, menstruation.
Cerumen, the wax-like material secreted by cells in the external auditory canal.
Cirrhotic, affected with cirrhosis, *i. e.*, a condition in which the tissues of an organ first become thickened and then atrophied and hardened.
Coaptation, the adjustment of separated parts to each other.
Contour, outline.

Detergent, a cleaning agent.
Devitalize, to deprive of vitality or life.
Diaphoresis, profuse perspiration.
Dicrotic, having a double beat.

Ecchymosis, an extravasation of blood under the skin.
Effusion, the escape of fluid from its containing vessels into tissues or cavities; the effused fluid.

EMBOLISM, the passage of an embolus from one part to another.
EMBOLUS, a thrombus which moves from its primary location.
EMOLIENT, soothing.
EXTRAVASATION, the escape of fluid, *e. g.*, blood, from a vessel.

FURUNCULOSIS, the diseased condition associated with the appearance of furuncles or boils.

GLOMERULUS (pl. glomeruli) a coil of blood-vessels in the capsule or expanded end of an urinary tubule.

HEMOLYSIS, disintegration of blood-corpuscles, especially the red cells.
HOMOGENEOUS, of uniform consistency or nature.
HYPEREMIA, an unusual amount of blood in a part.
HYPERTONIC, having abnormally great tension; a solution is said to be hypertonic when it has a higher content of salts than the blood.
HYPOTONIC, having an abnormally low tension; a liquid is said to be hypotonic when it has a lower content of salts than the blood.

INANITION, exhaustion from lack of nourishment.
INGESTION, to take into the stomach.
INIMICAL, unfavorable.
INTERSTITIAL, pertaining to the connective tissue of an organ. Occupying the space between the parenchyma or special tissue of an organ.
INTRAVASCULAR, within a blood-vessel or vessels.
ISOTONIC, having a uniform tension; a liquid is said to be isotonic with the blood when its salt content and, therefore, its tension is similar.

JUXTAPOSITION, close together.

KARYOKINESIS, cell divisioning in which the partition is preceded by certain intercellular changes.

LEUCOCYTE, a colorless, granular, nucleated cell capable of ameboid movements, *e. g.*, the white corpuscles of the blood.
LUMEN, the space inside of a tube.

LYMPH, the liquid which fills the tissue spaces and the lymph vessels. The greater part of the lymph in the body is derived from the blood by transudation from the capillaries, but it also contains waste material from the cells and, in vessels leading fröm the intestine, absorbed fatty material.

MALAISE, a general feeling of illness and discomfort.

NECROSIS, death of tissue.

OPSONIN, a substance in the blood that renders microörganisms easily absorbed by the phagocytes.
OXYHEMOGLOBIN, hemoglobin combined with oxygen.

PETECHIÆ, small spots formed by the effusion of blood. The term is also sometimes applied to the spots present in typhoid.
PHYGOCYTOSIS, the destruction of microörganisms by phagocytes, *i. e.*, cells that destroy harmful foreign substances, as bacteria, by enveloping and absorbing them.
PRECURSER, forerunner.
PRODROMAL, warning, indicating the onset of disease.
PRONE, lying with the face downward.
PROPHYLAXIS, the prevention of disease.
PSYCHIC, pertaining to the human mind.
PURULENT, containing or consisting of pus.
PYOGENIC, pus producing.

SALIVATION, an excessive flow of saliva.
SCLEROSIS, hardening.
SLOUGH, a mass of necrosed tissue in or cast off from living tissue.
SPLANCHNIC, pertaining to the viscera. The s. nerves, which have their origin in ganglia at the back part of the thorax and pass through the diaphragm to the abdominal viscera, control the caliber of blood-vessels in those parts. Stimulation of these nerves causes the contraction, and depression, the dilation, of those vessels.
STOMATITIS, inflammation of the mouth.
SUPINE, lying on the back.
SUPPURATION, the formation of pus.

THROMBUS, a clot formed in a blood-vessel during life.
TOXINS, poisons produced by bacterial action.

ULCER, an open sore on a cutaneous or mucous surface associated with gradual disintegration and necrosis of the tissue.
ULCERATION, the formation of an ulcer.

VIRUS, an animal poison. The term is applied more especially to toxic matter produced by, and that will produce, disease.
VISCERAL, pertaining to the viscera or internal organs.
VISCID, sticky or glutinous.

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